LIFE SCIENCE

TARAPADA CHATTERJEE

Recommended by the West Bengal Board of Secondary Education as a Text Book for Class VI of all Schools of West Bengal.

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LIFE-SCIENCE

[PART—I]

[***For Class VI Students.***]

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PREFACE

The modern age is an age of science. So, the only way to keep pace with this progressive age, is to enrich our knowledge in the varied aspects of science. There is no end to learning. We must remember that the more we learn, the more we step forward with this progressive age. Particularly, the spirit of the new syllabus is to attract the young students towards science. With an eye to the fulfilment of this object, the Board of Secondary Education has come forward to implement the ten-class new syllabus from 1974. There is no doubt that, instead of the usual monotonous course of Biology, the new syllabus of life-science, a novel one, is more attractive and presents multipurpose idea. It is not unknown to the experienced and thoughtful teachers, how difficult it is to stamp the impression of the plant and animal world as complementary to each other on the mind of the tender-aged class vi students.

Attempts have been made to emphasise the conceptual understanding and reasonsing of the students, rather than retention and reproduction of facts. The spirit of the syllabus has a practical bias and the student is expected to gain knowledge through simple experiments, conducted by teachers and students. Accordingly, simple experiments have been discussed in the text, which may lead them to a clear understanding of scientific facts.

"To err is human"—so is to me. I would request the respected teachers to kindly point out any error of the book. Further, any proposal for betterment of the book, will be gratefully acknowledged and will be incorporated in the subsequent edition.

Lastly, I must express my indebtedness to Sri Debasis Biswas for helping me in the translation of the book, but for whose help, this book would not have come out within this short period.

Dated
28.7.74

Author

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Syllabus of Life Science

CLASS—VI

1. Student and his environment.
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3. Observation of living objects with an eye to the training of the sense organs of the students leading to general inference.
4. Observation of living objects through simple experiments :— requirement of light, air (oxygen), water and nutrients for their existence.
5. Basic external structure in (a) Plant...example (Pea) (b) animal·····example (fish and man)

N. B.—Field excursion (at least 15) will have to be arranged so that the students may have a direct idea about plants and animals in their own environment.

APPENDIX

So far we have discussed on various aspects of living organisms. Animals and plants are not simply an assemblage of parts living in seperation from the world. Each individual is, after all, an organism, in which all parts are adjusted to the life of the whole. Further, we have noticed that, there are fundamental similarities in structure and life processes between the plants and the animals. Living organisms are remarkably able to regulate their own lives in response to the changes around them. They maintain normal forms and physiolgical activities inspite of changes in the environment.

The relation between very simple and highly developed organism is one of understanding. For instance, we find in the plant world very primitive and lowely organised algae, moss and fern, living side by side with large trees. Similarly, amoeba-like simplified single-celled primitive animals are living side by side with large animals. This is because all of them have adapted perfectly to their environments.

We are not always conscious about the benefit we have been deriving from the plants, since the creation of the living world. It is the plant, which traps the solar energy during its preparation of carbohydrate food. This is the chief, if not the only source of energy of all animals, including man. Hence, plants are not simply helpful to us, without plants, existence of life in this planet of ours, is not possible. Besides, plants are variously utilized by various animals, for healing sickness. As fuel, plants are of great importance to men, since, coal is also formed of plant bodies, buried under soil in past geological times.

Amongst animals, many are our helpful friends. Some, however, are harmful. Many animals have been domesticated by man to serve from the dawn of human civilization. Cow, horse, goat, sheep, donkey, camel, elephant are some of them. If we consider cow or goat as a helpful animal, we will find, in how many ways we derive helps from them. Cow gives us milk—the most nourishing food ; it gives us cowdung—used as fuel and fertilizer ; its skin is used as hide, which is variously utilized to prepare shoe etc. ; its intestine is used in making the fibres of playing rackets ; its bone-dust is used as fertilizer. Many other animals also help us in various ways. Some of them, as fish, are widely used as

food of ours. In the same way many insects also supply us with useful products. Many commercial products, produced by insects, are indespensable to modern man. Honey and bee-wax, as pointed out earlier, are produced by the honey-bees. The silk-warm supplies the commercial silk. Lac insects secrete wax, known as shellac ; certain dyes are produced by certain insects.

Besides, the greater service, renderd to mankind by our "insect friends", is the pollination of flowers. As scavangers, many insects, like house-fly, maggots etc. feed upon the waste materials, such as the dead bodies and refuges of plants and animals. Many animals and maggots devour carcass of animals voraciously.

Further, a very important service, that insects perform to exercise biological control over other important insect enemies of man. The insect (or any other animal) which lives on other insects are known as **predators**. Such insects have been introduced to destroy many other harmful insects with success.

Many insects and larvae have been employed to treat severe bone infections earlier. However, the medicinal value of bee poison has been accepted with limitations. Bee-poison is also used in the preparation of midicine for snake bite.

But there are ample examples of harmful insects. Hence insects may be classified into groups in relation to man, as follows :—

INSECTS

A. Benificial (Discussed above)

B. Harmful,

i) Those who **suck human blood** and carry infection. Common examples— a) Mosquito, b) Bed-bug, c) louse, etc,.

ii) Those who **spread infection through our food**, common examples— a) House-fly, b) Cockroach, etc.

iii) Those who **spoil our belongings**, common examples— a) wood-mite, b) silverfish, c) Termite d) Cockroach e) Cricket, etc.

FIRST CHAPTER

OUR ENVIRONMENT

What is environment ?

What do we mean by environment ? Well, let us start our discussions from 'our home'. There we have tables and chairs, books and copy books and many other things around us. There are light, air and water ; our parents, brothers and sisters, as well as a number of relatives and neighbours. But don't forget that active lizard on the wall of your study or the cockroaches and spiders in your kitchen. Besides them there are quite a number of crows, sparrows,

Room-environment

cats and mice. There are also potted plants in your roof. Wait, I have still to mention the houseflies and mosquitoes, which irritate you so much. And a sumtotal of all these things is our environment.

Now, it is clear that all the things, which lie around us and amongst whom we live, constitutes our environment. This environment, hence, surrounds us. Just think for a moment and you will find that there are two divisions of this environment. One of them constitutes of non-living or inanimate things, while living or animate things (just like you !) the other part. We do not visualize all the things which belong to these two parts. Take the example of air. We cannot see, but feel it fully. Again, there are several inanimate things which were once a part of some living objects. Don't you remember your shoe whose leather was obtained from a cow ? The chair on which you sit frequently (and probably at this moment also) has been made from the wood of a tree which was once as animate as you. Now, we must adapt ourselves to both the parts (inanimate and animate) of our environment, for we depend on them to maintain a healthy life.

Now, let us come out of the campus of our home and enter a greater environment. Besides your relatives, there are a number of men—familiar and unfamiliar, in the streets and the market. There are many kinds of herbs and shrubs, buildings, vehicles, newer sights and sounds and also a greater quantity of fresh light and air. Avoiding the crowd if you move towards more lonely places and reach a meadow or field (of course not in Calcutta or a sophisticated town !). You will find that the space around you is more void. A few trees are around you and soft green grasses under the feet. Possibly you will find a squirrell to run away swiftly.

Following the sweet chirping you will find several kinds of birds there. If you come near a shrub, you may find a creeper full of tiny nice flowers. Now

Village-environment

you proceed to pick a flower and a lizard jumps out of the bush ! You will, I am sure, spring back. At this moment a severe thunder-clap may remind you that the sky has become overcast with clouds. As you see frequent lightnings in the sky, you hurry towards your home—feeling the flaps of stormy wind every moment. Thus, you return to your smaller and more familiar environment from the bigger one.

Classification of environment : Animate And Inanimate.

Perhaps, in the mean time, you have come to know that our adaptation to inanimate part of the

environment (as light, air, storm, lightning, street, drains, etc.) is no less important than that to the animate part.

Inanimate Environment :

We find a number of stars and planets in the cloudless sky. Some of them are nearly equal to our earth in size while most of them are several times (often greater than all the hairs contained in your body) larger. They look so small for they are at a great distance of several millions of miles from us. The stars are burning masses of gas just like the sun but the planets are like our earth. The planets cannot give light or heat, yet light reflected from their body reaches the earth; unlike stars, the planets do not twinkle. Moon is the satellite of earth and hence it is much nearer to us. But practically, all the light and heat of the earth comes mainly from the sun. Light from the sun falls on the moon and the moon glistens to give moonlight. But there are hills and canals, holes and pits in the moon ; so we find several dark spots on the moon.

If there were no sun, the earth would become not only veiled with darkness but also it would freeze for the want of heat—causing the death of all the living beings. It is due to the heat of sun that water from ponds, rivers and seas vapourise and go upwards to form the cloud. This cloud utlimately gives back rain. Thus, the earth cools down and the farmers can produce crops.

We cannot see without light, cannot stay a while without air and cannot live in extreme heat or cold. Again, when we feel thirsty, a glass of water becomes

much more precious than a glass of pure gold. So, for the continuance of our life, we depend greatly on the quantity of light, heat, air, water, etc. which we get every day.

The environment changes with the change of seasons which needs proper adaptation. Everything becomes dry and rough in the winter—plants shed their leaves, we shrink up with cold. Throughout the winter tiny dewdrops accumulate on the grass or the leaves. This so happens for the cold air at night cannot hold the same quantity of water as it held in the hotter state during the day. This excess of water accumulates as dew-drops on different substances. In the spring, the trees and plants teem with flowers. After summer, the rainy season floods away all around with water.

You know that three-fourths of surface of the earth is full of water. So water occupies a considerable part of our inanimate environment. But most of the water is confined in the seas and oceans and hence they are rendered unusable. The rain water washes the soil and the salts mixed with the soil get dissolved in that water. This salty water again goes to the sea through the passage of several rivers and rivulets. This is why sea water is too salty to taste. But common salt (whose deficiency in a curry prompts you so much to reproach your cook) is prepared from the sea water.

But the water of ponds, canals, rivers, wells, etc. is sweet. We drink this water. Also, our workshops and factories, cultivation and irrigation, above all, our normal life will come to a standstill for the

want of this type of water. In villages, there are rivulets and canals flowing through the cornfields and they supply necessary water for cultivation. But, during flood, those canals overflow and floods away the fields. Thus, the water, which gives us life, now destroys life and properties of a man. Now you understand it full well that our environment often changes and we are to tune up perfectly with it continuously.

There are many things in the inanimate environment which we cannot see with our eyes but feel somehow. Such a thing is air, which has no taste, colour or odour and which is invisible. Also it is so light that it has practically little weight. But what's about its power ? The wheels of the vehicles are pumped with air and hence they can carry loads (thousand times heavier than you !). Thanks to air for it carries aroma from one place to the other. Just think of a situation when you hold up a rose just near your nose and feel no smell ! But the greater inconvenience in such a case will be of some different kind— you will die of suffocation (close your nostrils for a short time and see what happens !). Actually the most important part of our life process is respiration which is solely concerned with the intake and giving off air. Actually one-fifth by volume of air is oxygen which is essential for respiration. Aquatic animals take oxygen from water in dissolved condition.

Now, when rate of wind-flow is less, we feel discomfort owing to sultriness and when it is high, we are apt to catch cold. A highly swift flow of wind, i.e., a storm often kills animals as well as plants.

Oxygen of this wind not only helps in maintaining the life process but it helps in any type of combustion also. Actually, burning does not take place without oxygen. Invert a glass-jar (one-mouth) over a burning candle. When the oxygen inside the air is exhausted owing to continuous burning, the candle becomes extinguished.

Matter and Energy :

In both the animate and inanimate environment, most of the constituents are matters—of one kind or other. Now what is matter ? It is one which has some mass and which occupies some space. The matter, which has a definite size or shape, is called an object. Thus, wood is a matter, while wooden chair is an object. Water, air, coal, gold, silver, —all these are matters. We get matters from environment (or, nature) and we make objects from them.

The ability of doing work is expressed as energy. No one can do any work or even move from one place to the other unless one has energy. So, for maintaining life-process, one must have a continuous supply of matter and energy.

Animate environment :

There is a large assembly of different animals around us. It will be quite a difficult task for you to find a place on the earth where one can find no living object. But there is no such guarantee that they must be visualised by our two eyes. There are millions of animals which remain invisible to these two naked eyes of you. Beware ! don't ignore them. Brisk activity of a number of such organisms

may force you to cancel all your programmes and lie on your bed in an utterly helpless condition under the thorough treatment of a renowned doctor. The smallest of such 'smalls' is the *Bacterium* (pl. Bacteria.). It is not impossible that the pages of your 'Life-Science' now infests with Bacteria. It also is not absurd that the bacteria present in your skin may outnumber all the biped intellectuals in this world. Bacteria are present in and outside of your body, at the bottom of the Pacific and top of the Everest, in the crisp air as well as inside the lump of ice-flakes at the polar region. But all of them are not injurious. Some of them are indispensable for healthy life-process of higher animals. There are also several tiny plants and animals in this world—too small to see without a powerful microscope—which are involved closely in our life. Besides them, we often meet a number of plants and animals which are quite large so that you may study them conveniently.

Similarities and dissimilarities between animates and inanimates : interdependence of them :

The distinction between animates and inanimates is not an obvious one. Yet, there are few characteristic features of living things which the non-living ones have not. Say for example, animates take food. Fasting for a short period will make you weak, for the food provides with necessary energy for doing work. Again, this food gives you nourishment in absence of which you would never be able to grow up like your father after a few years. The plants cannot take solid foods. So they draw food matters from the soil in a dissolved state. But tehy prepare

their food (which may be readily absorbed by their body to provide nourishment) inside the green leaves with light, carbon-dioxide, water and the absorbed raw food materials, in presence of chlorophyll. On the other hand, an animal cannot prepare its own food and depend on those plants in some way or other. Say for example, the herbivorous animals live on the plants and the carnivorous ones eat those herbivorous animals. Thus, all of them actually depend on plants for food. When the plants and animals die, their bodies, in natural course, become buried under soil, or burns or becomes rotten; ultimately they mix with the soil and increases its fertility. In the next process, Bacteria play a prominent role. Thus, from the very beginning of the creation, the plants and animals are showing an excellent interdependence. There is another novel feature in the living object. A living thing is produced from another such living thing. The life begins with birth, it advances by drawing nourishment from food and ends in death. But an inanimate object exhibits no such cycle. Add a handful of sand to a sand-heap, the latter will grow in size. Thus, an inanimate object increases in volume by the addition from outside. A piece of wood grows in size by a more addition of some wood to it. But the growth of a living thing occurs in a slower rate owing to the nourishment from inside of the body. If a surgeon wants to increase the length of your hand by adding another hand to it, you will surely suggest your father to send him to a Lunatic asylum!

A living object can move at will but a non-living one fails to do so. A table or a cot does not move

until it is pushed, while the movement of an animal is easily observed. What's about the plants? They show partial movement, i.e, standing at the same place, they move their parts (like leaf or twig) when necessary. The flower blossoms by the gradual opening of the petals. A number of creepers move upwards by the moving activity of the tendrils present in them. There is yet a more interesting case among the plants ; a peculiar specimen named 'pitcher-plant' opens and closes its trap for catching insects. Perhaps you have already prepared in your mind to ask why a train or a vehicle (which moves so fast from one place to the other) is not called an animal. The answer hides in the fact that their energy comes directly from outside—from petrol, electricity, etc. On the other hand, animates derive energy out of food from inside their body. No one is required to move an animate mechanically. Again, the part of the food unsuitable for use and harmful waste-products are thrown out of the animate body but this does not happen in the case of an inanimate object. Animate response to stimulus (remember an electric-shock which made you shout—Ah !). Observe the insects which rush towards light. But for an owl, the case is reversed. It avoids light.

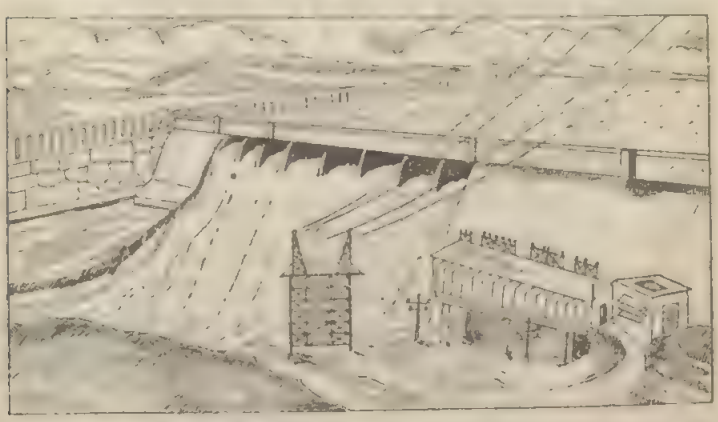
Dependence Of Animates On Environment :

Let us return to the patent fact that adaptation to environment is unavoidable for continuing life-process. Everyone changes its mode of life, food-taking and structure of its body to suit itself with its environment. Thus, camel, which lives in the desert, can bear the extreme heat, cold and characteristic

difficulties of that place and hence it has peculiar structural make-up. But an animal of a comfortable land will be unable to live in the desert. Again, you will rarely (rather, never) find an animal of the plane in a hilly region. A bird does not stay in the sky permanently and comes down on the ground or elsewhere for rest Though a plant does not fly, its seeds are often spread around through the air. Also it is obvious that the animals assemble in those places where they may get plenty of water, air, food, etc. permanently.

Natural And Artificial Environment :

Man, with the advancement of civilization, has added a number of self-made things to the natural



Artificial environment

environment and thereby changed it partially. This made the life of man more comfortable while the environment and many other creatures have suffered a lot. Town sand cities have replaced forests and hills. Water is now stored in large artificial

reservoirs. The wild motion of rivers are restrained by constructing dams and electricity is produced at the expense of that motion. A large number of factories have been made by man which are producing several articles to facilitate our life-process, but on the other hand, the smoke that their chimneys puff out pollutes the environment. The scientists are trying to take proper measure against this, for the environment pollution is injurious to our health.

Earthly Environment : Man And Space

Now-a-days, the scientists are searching for our more distant neighbours of the space. To know whether there is life on other planets, the scientists are sending astronauts from the earth. Man has fetched the lunar rocks from moon and brisk experiments and research works are going with them. There is no life on the moon. So, further investigations are necessary concerning other planets. But trip to those planets is not impossible for man, for, the scientists have made proper arrangements in the space-ship so that the astronauts may feel quite at home in it. [Remember the weight-less condition during such exploring in the space and absence of air, water, etc. in those planets where the temperature may be either too high or too low.] So, the essential condition for such exploration lies in the fact that the astronauts should carry exactly the same earthly environment with them in some artificial way. Well! are we not back to the much discussed truth that man is always dependent on his environment ?

EXERCISE

1. What do we mean by 'environment' ? Explain how our life is concerned with both the living and non-living objects.

2, Why both plant and animal are living organisms ? Narrate their general characteristics.

3. Why and how we are dependent on non-living or inanimate environment ? How do we get the main energy for maintaining life ?

4. What do you understand by the expression, 'living beings are dependent on their environment' ?—Explain with examples.

5. What is meant by natural and artificial environments ? How do the scientists go out of the earth's environment ?

6. Objective questions. Write **'Yes' or 'No'**—

(a) We can notice all the objects of living and non-living environment.—Yes/No.

(b) As moon is the planet of earth, it is near earth.—Yes/No.

(c) Planet has the capacity of giving light and heat—Yes/No.

(d) In winter season dews accumulate on grass from the sky —Yes/No

(e) We take in the oxygen of air during inhaling—Yes/No

Fill in the blanks :

(a) The smallest creature on earth is.....

(b) We can not kindle or burn a thing without.....

(c) We cannot drink sea-water, as it is too.....to taste.

(d) The substance, which has a definite shape, is known as...

(e) Animate things grow due to.....

SECOND CHAPTER

ACQUAINTANCE WITH ENVIRONMENT

Introduction

There are so many living and non-living things lying around us. But we feel no more novelty in a few of them for we see them so much. Say for instance, we do not become surprised at seeing a river or a hill as well as a mango-tree or a crow. For we think, there is nothing more to observe in them. We are not quite wrong in thinking so, but a greater acquaintance with them is necessary. Similarly, we are in contact with air, water, different food-matters and articles for domestic purpose, but we know little about them. We do not even notice a few of them. But we should learn both of our animate and inanimate environment for our own interest.

We can perceive the inanimate objects with our sense organs only. Camphor, Kerosene, Sulphur etc. can be identified only by smelling them. It is also not difficult to identify copper sulphate or brick-dust with the pain of eyes. If your tea be served with a spoonful of salt in stead of sugar, you will distinguish the taste too bitterly. Again, the two sensitive ears of you will help to know whether a taxi or a rickshaw is passing behind you. You will, surely, never think a thunder-clap indentical with the whistle of a train. If you shut your eye-lids, block your nostrils and plug your ears, you will still be able to distinguish easily a little flour from some sugar—the skin of vour hand will help you to do so.

Be acquainted : Identify various living and non-living forms by their popular name. :

We are bound with the animate enviroment all the more, for we ourselves are alive. A number of animates are the daily companions of us. From the very childhood we come to know about many characteristics of those living creatures through different experiences. There are a number of plants and animals lying around us. We must not harm the plants and animals beneficial to us and must be cautious about those harmful to us. But before this we must gain a first-hand knowledge about them, so that we may distinguish a harmful plant or animal from a beneficial one. However, you must know that there is no plant or animal exclusively harmful, all of them are beneficial in some way or other. The number and type of living beings depend on the natural and geographical condition of the place. Say for instance, in the plane where rainfall is proportionate, various kinds of plants grow there. Sometimes even the thick growth of plants give rise to a dense forest. So, a number of plant-dependent insects and several animals, exdending from small to big size—are found there. To the south of our country is the sea and to the north is the Himalayas. So, the number and type of the plants and animals of the plane are different from those of the costal region or hilly place of Darjeeling. Again, the plants and animals of the 'Terai' region in the north are almost entirely different from those in the thick jungle of Sundarban in the south. Again, owing to severel natural and geogra-

phical reasons, it becomes impossible for an animal (or, a plant) to go to and propagate in some different environment. The only exceptions are the migratory birds, which fly to other lands, often several hundred miles apart for laying eggs.

However, a keen observation will show that all the places have their cheracteristic types and numbers of plants and animals and those inhabitants have uniformly adapted themselves with their respective environment.

Plants :

We often think only of the trees when the term

Moss Fern

'Plant' appears in our mind. But remember that the minute green scum-like substances often found in the ponds are also plants. Even the mould that

grows on wet shoes, rotten food-matters and clothes, is also a kind of plant. Unlike other plants, it is not green but like carded cotton. The mould absorbs ready food matters from the substance on which it grows. It belongs to the group called 'Fungi' [Sigular-fungus]. Green moss, which often turn the floor of your bath-room slippery, is also a plant. This type of plant is actually called Algae according to the scientific terminology. The actual moss is one which is larger in size and grows on wet wood, moist stone etc. Another kind of green plant

A Climber

is often found on the bank of the ponds and on the moist soil. Such plants have long, incised, beautiful leaves and a nice appearance as a whole. They are Ferns. As you advance towards the hilly regions, you will be astonished at the number and varieties of such plants. Green velvet of moss on the wet stones beside the hilly rivulets and the array of ferns along the two sides of the fountains will be charming

enough to glue your eyes for several hours at them. The algae, moss and fern are the plants of lower and simple kind. But most of the plants we come across everyday are higher plants which produce flowers. So, they are called *Flowering plants*. They are roughly of *four* types The plants which are too weak to stand erect on the ground are called *creepers*. Some of these creepers only creep on the ground (e.g. grass), while the others climb up by turning round a support with the help of sensitive tendrils. Butterfly-pea Aparajita, Bean, Pui (B) etc. are such creepers which climb up somehow, are called climbers. Gourd, cane etc. are such tendril climbers. Dodder [Swarnalata (B)], a type of climber, is a parasite, for it draws its nourishment exclusively from the plant along which it climbs up (How nice is the name and how blameworthy is the nature !)

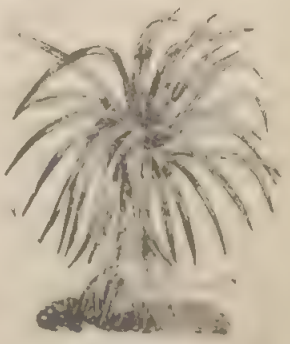
If you have the opportunity of going to a village, you will see paddy-plant, mustard, radish, carrot, ginger, plantain etc. plants frequently. Now, all of these plants are termed as *herbs*. They generally attain a height of a man's waist. Their stems are soft and full of sap but without hard wood to provide the plant sufficient strength. A number of such herbs live through only one season and complete life-cycle during that period, *i. e.* grow, develop, bear reproductive organ, propagate and die. They are called *annual herbs*, *e.g.* paddy, mustard etc. Again, a few plants like radish and carrot live through two seasons and they are called *biennials*. But the rest live through several seasons and hence they are called *perennials*. Banana, ginger, turmeric etc. are perennial herbs. They bear flowers at least once in a

season and even if the shoot becomes destroyed, the underground part of the plant continues to remain

Paddy Mustard Radish

in a living state and bring forth the shoot in favourable season.

The plants which constitute the coppices around us are known as *shrubs*. A number of branches grow from the stem of such plants and give it the appearance of a bush. A shrub has no stout trunk but the stem is quite hard and woody. China-rose, screwpine and common-rose are the examples of herbs. Generally they attain a height of two to five feet.



Screwpine

The plants, genarally know as 'trees', are quite tall and their stems are broad and stout. The basal part of the stem is called trunk. At a certain height of the stem, a number of branches are given off. You will see a tree of some kind or other almost everywhere. Mango, jack-fruit, black-berry, bamboo, cocoanut, plum, etc. are trees. They have root, stem, branches. leaves, flowers, fruits and seeds.

Mango-tree

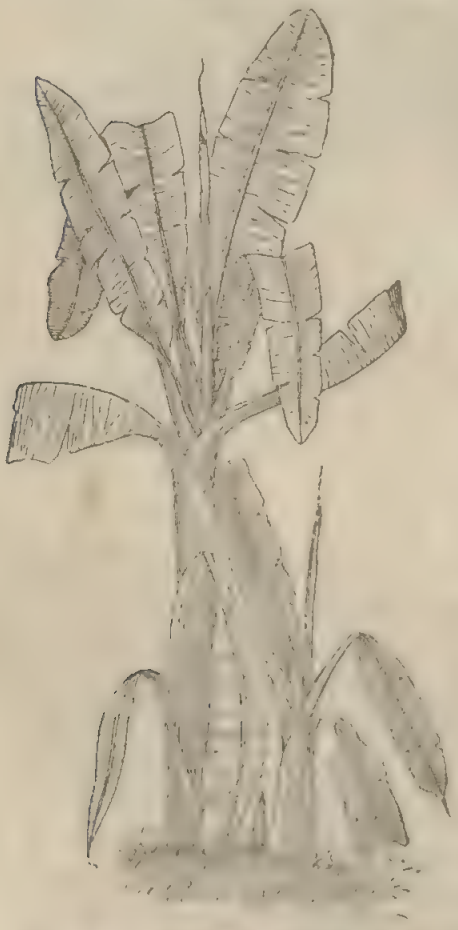
Now, let us scan the common plants in the fields and meadows. Behold, there is a clump of bamboos. The nodes in the body of a bamboo are at almost equal intervals. The leaves are pointed. The plants, seeming to stand on 'one leg' on the bank of the ponds, are the cocoanut trees. They have no other branches except the cluster in the head. The long stem is uniform and bare. But the date-palm trees have ridges on their bare stems. Those ridges have been formed owing to the shedding of leaves, for stalk of leaves remain attached to those places. In the winter date-juice is collected from the tree and molasses is prepared. You are unlucky enough if you have not yet tasted any of the three—dates, date-juice and date-molasses. Now look at that

massive plant. Yes, you know it well, it is a banyan tree. There are several slender steam-like stuctures hanging from the branches of the banyan tree. But don't be deceived ! They are roots and not stems or branches ! They help the large tree to stand erect on the ground, for, they reach the ground and assume the shape of a stem. And, in such cases, it will be quite a puzzle for you to identify the actual stem (don't forget, except that stem all other 'false stems' are really roots) ! There are several banyan trees which occupy considerable area on the ground.

Banyan tree

The stout trunk and the branches are the shelters of many a bird, squerrels and several other animals. There is the horse-radish, "Sajne" (B) plant. In a common Bengali dish you may find almost entire a plant ! Don't be surprised. The stem, fruit and flower of this plant—all are edible. On that corner there are several fruit-growing trees Though it is mainly a mango-grove a number of fruit-growing trees like lichi, Jackfruit and star-apple is also present there. How broad are their stems and how numerous are their branches. Observe the mean height from which the branches are given off. You may catch hold of the lowest branch by a single jump. But mark that there is no uniformity in the size of the branches

and they are produced at random. This is true for all branch-bearing plants. The leaf of a Neem tree has a number of small leaves (leaflets) in it. Similar is in the case of a tamarind-leaf. The leaf of plantain is very big and fan-shaped in appearance. From the plantain-flower (known as 'mōchā' in Bengali house) plantain is produced. But the size of arum-leaf is greater than those big plantain leaves. Arum, just like Turnip or 'oal' (B.), grows under soil and both are edible. Now let us proceed to the paddy-field where the paddy plants are arranged in symmetrical array. They are just like long and thick bunches of grass. In west Bengal, the main agricultural products are paddy, wheat, Sugarcane, pulses etc. Besides them, brinjal, potato, onion, lady's finger, gourd, bitter gourd etc. are also grown



Banana grown-up and young plants

In the garden or around the abode of a common Bengalee, flower-yielding plants like jasmine, Butterfly pea Aparajita, 'krishnakali' (B), balsam etc. are often seen. There are a number of small and large moppice, grown uncared, which produce tiny colourful flowers. On the fence of the house, a few types of flowering plants like Akanda. Dhalkalmi, Tarulata (B) etc. grow often. Besides them, several flowers as rose, dahlia, Arabian jasmine, tube-rose, chrysanthemum (chandramallika), marygold grow in different seasons. Some of them have an excellent, some others have enchanting fragrance and a few of them have both.

Now, on the way of retreat, let us have a look at the pond. A few white water-lilies are floating in the water. A type of moss has formed a green scum on the water surface. Along the bank, there are 'Susni' (B,) and 'Kalmi' (B.) which are edible vegetables. There are also numerous water-weeds on the bank which you may also find in the aquarium of some of your friends.

Animals :

Just like the plants, there are also numerous kinds of animals moving here and there. Most of them are too small to identify and study and hence we do not mark them generally. Don't get disappointed. Let us first study those larger animals which are often seen everyday. We may easily identify them by knowing their colour, behaviour, sound and characteristic features.

You may find a number of animals if you have a curious search in the nearby field. In the rainy season you may come across a number of leeches. Similarly, numerous earthworms may be found by

digging at random in the ground with a small sharp instrument. The body of both leech and earthworm are made of small soft ring-like structures. They have no hands or legs. The earthworms live by eating rotten leaves, smalls insects and humus of the soil but the food of leech is the blood of other animals which they suck in some opportune moments. Leeches live in water also. The earthworm, leech and other animals of their kind move along the ground by the alternate contraction and expansion of their body. Nicely-coloured butterflies move from one flower to the other and suck nectars. Grass-hoppers, wasps, hornets etc. also do so. The wasp and the hornets have stings. They protect themselves from their enemies by piercing the sting. During their flight, a peculiar humming sound is produced by

Earthworm

Butterfly ← (In sitting position) → Moth

their wings. Bees construct bee-hives in large trees. We get honey and wax from those hives. we get

silk from the silk-moths. Bee, Silk-moth and many other insects are beneficial to mankind. The wasps also form hives but cannot produce honey.

If you have the opportunity to walk along a rural way during night, you will find a number of glow-worms twinkling and flying to and fro. Moth, similar to butterfly in appearance, but without much colouration in their wings, come out at night. Numerous small green insects are found just before the Hindu religious festival 'Shyamapuja' in October. Those insects are called 'shamapoka' (Jessids) but they have no relation with that festival. It is not out of place to mention that 'Shama' means 'light' in Arabian language. These insects

House-fly (seen from side) Termite (white ant) Cricket

move towards any sort of luminous object and often burn to death in lamps. A common but disturbing insect is cricket which scampers here and there at night, often spoiling the meditation of a serious student. Glassworm—a coloured lustrous insect—is also common in Bengalee household.

There are numberous insects present in our rooms. You will find cockroaches in abundance along with bed bugs, houseflies, spiders in your house. You may also come across 'silver fish'—a worm with lustrous appearance of silver. There are also very harmful insects as bugs, book-worms, lice etc. present in most of the houses. The elaborate description of how they harm us, which you know quite well, will simply frighten you. Our busy search for spray guns (full of insecticides) at night

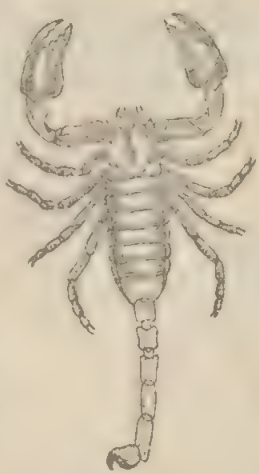
Culex ← Mosquito → Anopheles

proves how exasperating and harmful are the mosquitoes and houseflies. Housefly, cockroach etc. carry serious germs in their legs and wings while mosquito injects germs in our body when it bites us. Again, beetle, mole-cricket etc. are often found under the heap of hay and cowdung. 'Majra', 'Pamori' (B.) etc. are the insects found in farmyards which are too dangerous pests of cereals.

Prawns, crabs etc. live in the ponds. The leeches in the pond suck blood from other animals

Near the wells or the taps, scolopendra and ear wigs are often seen, especially if it be a rural area. Both of them have numerous paired legs. They are called centipede (Centi = hundred. podus = foot).

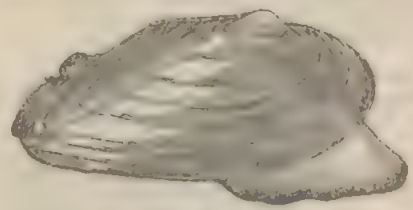
The scorpions have stout antenna and these animals have poison, which produces so much pain when a scorpion stings an animal. They often reside in the furrows and chinks of the bricks and broken walls. Behind the almirah, in the ceiling and in many other places you must have seen spider-webs. The spider catches the insects with its cobweb and devours them up.



Scorpion

Centipede

If you go near a pond, you will find a number of snails, water-snails, oysters, mussel etc.. In the rainy season, garden-snails, are found to move with their two tentacles raising upwards. Two eyes of them are situated at the tip of each of the two tentacles. All of these just-mentioned animals have a soft body covered by a hard shell, somewhat spiral in shape. The fishes reside in water. Rahu, Katla, Mrigel, Kalbasu etc. are large palatable carp fishes. There are also a few small fishes, no less tasty than Rahu or Katla. Punti,



A mussel of the pond

Maurala, Khaira (B) etc. are some of them. A few fishes like Shingi, Magur and Koi have the peculiar ability to live out of water for considerable time. Sheat-fish (Boyal fish) devours up other small fishes. Besides them shole, lata, Bata (B). etc. are a few common types seen in almost all fresh-water tanks and ponds.

Rohu—a major carp

Frogs and toads live in the bushes and holes. Toad is smaller in size than frog. The frogs usually remain near water. Both of them hop heavily. They can also swim in water. They spawn eggs in water from which tadpoles grow. These tadpoles develop into frogs or toads. So, a toad or a frog can live both in water and on land. You have certainly observed how the house-lizard in your room catches insect and eat them up.

Tadpoles

Toad Frog

Another type of lizard, called garden-lizard (calotes), which lives in bushes and forests, catches insects with its long sticky tongue. All of you have seen snakes. All the snakes are not with venom. Water-snake, Jaldhora (B.), which lives in fresh-water is not venomous but sea-snakes are. Similarly, many snakes on the

Garden-Lizard

Hooded snake

land e.g. grass-snake, Hele, Laudoga (B.) etc. have no poison. But there are numerous venomous snakes, a single bite of which can make one slept for ever. Cobra, Russel's-viper, King-cobra etc. are such messengers of death. They have hoods which they spread before attempting to bite someone.

Crow is famous for its habit of stealing. It is familiar to all of us. It has, somehow, mastered the art of stealing foods, eggs and young birds. Crow builds its nest on electric wires, branches of trees and in many other places.

A small but brave bird is sparrow. You have surely marked how dauntlessly they hop here and there in your portico, verandah and even inside your room. They build temporary nests for laying

eggs. When young birds hatch out, they feed their offspring with their mouth (no less affectionate than a human mother indeed !)

Left—Bulbul ; Right (Upper)—Crow ; (Lower)—Sparrow

We avoid kites They are quite large in size, brown in colour with a cleft tail, bent claws and sharp stout beak. When they cry loudly with their characteristic note sitting innocent on the top of a tree or on a high roof, they still go on planning for the next prey to be snatched (Beware of the kites when you move along the way with some delicious food in your hand !). But the kites also help us by devouring up rotten animals and several other dirty things (of animate origin) A particular kind of kites, somewhat white in colour, are found near the sea. They are known as Sea-gulls

Another bird, much familiar to us, is pigeon. They usually live in brick-built houses. There are

several kinds of pigeons. The characteristic cooing

Kite Vulture

of pigeon is a common element in rural Bengalee abodes. A few kinds of pigeon are kept as pet birds.

Among the larger birds, Vulture lives near the funeral places and places for caracasses. They are extremely ugly in appearance but look better during their flight.

Cow

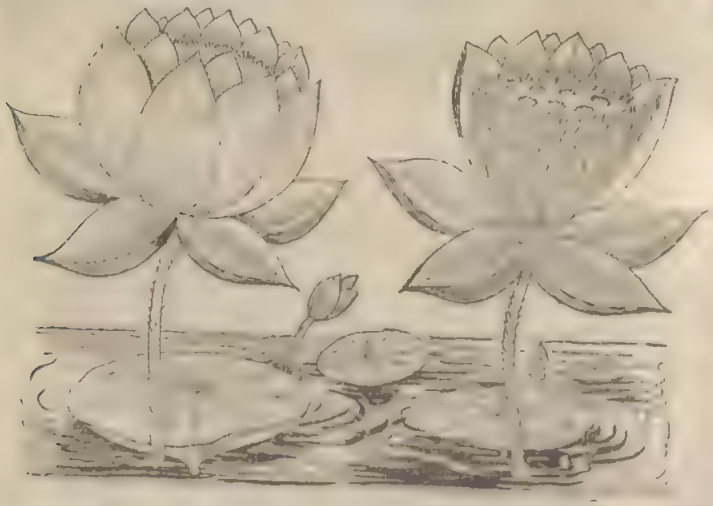
Dog, cat, sheep, cow, buffalo, horse, ass etc. are

quadruped animals most familiar to us. Many of them are useful domestic animals, The milk of cow or goat is the staple food of children. In crumbled houses live the bats. They fly during night and are nocturnal in nature. Unlike birds, they have no feather in their wings. Elephant is the biggest animal on the ground.

Special discussions :

(One) **Lotus**

Lotus is one of the most familiar and sacred flower to Bengalee. It is usually pink or pinkish-white in colour. In the religious festivals of



Lotus flower complete (Left) and half-withered (Right) ; Leaf and bud

Hindus, lotus is offered to God or Goddess as article of worship. Saraswati, the goddess of learning and wisdom, is portrayed with a lotus as her seat.

Lotus grows in water and is quite big in size. It is found throughout the length and breadth of India. Such a beautiful flower, whose very appearance suggests sacredness and purity, is worthy of being taken as the '*National flower*' of India.

The plant of Lotus is quite a long one. But most of the plant except the leaves and the flowers remain under water. The base of the plant remains in the mud under water. So, lotus actually grows in mud.

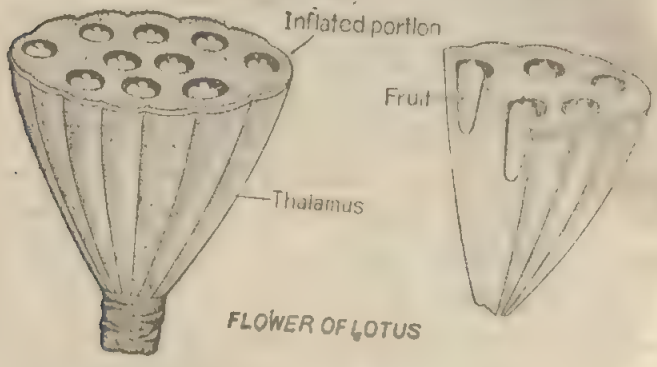
Different parts of a lotus :

The stem of lotus, like that of ginger, remains under soil. Such a stem is called 'rhizome'. The broad stem of lotus gives off bunches of roots which enter the mud and keep the plant erect and fixed. Lateral stalks are produced from the stem and they contain a circular leaf at the tip. The older stalks become stiff and project the leaf above water level. Other leaves float on water for the stalks holding them are weak. The upper surface of the leaf is dark green and the lower surface is reddish-pale green. There are several marks extending from the centre of the circular leaf towards the periphery. The upper surface of lotus leaf is oily and the margin is wavy.

Flower :

Lotus is quite big in size. The stalk of the flower originates from the stem and comes to the surface of water vertically. At the tip of each stalk there is only one flower. The different parts of the flower remain arranged in four whorls on a convex

thalamus. Towards the base of the thalamus is the first whorl, constituted of a number of green sepals. This is known as *calyx*. The next whorl is *corolla*, made up of a number of petals. Lotus has numerous petals, hence its name is Satadal (Sata = hundred, dal — petal ; B). The petals remain separated from each other. The petals towards the centre are small in size while those towards the periphery gradually increase in size (see figure). Thus, the inner petals remain covered by the outer ones. In a fully



blossomed flower, there is *Androecium* next to the corolla. There are fine thread-like stalks at the tip of which there are swollen, flattened structures, one in each stalk, known as *stamens*. These stamens contain pollen grains and constitute the androecium. At the centre of the thalamus there is the *Gynaecium*, the lower part of which remains connected with the flower. The upper part of it is flattened with occasional swellings (see figure). Just beneath each of these swellings a fruit forms in future.

Fruit :

When fruit develops, calyx, corolla and androecium shed and the thalamus full of fruit retains. This is called flower. The fruits inside the flower appear like fried rice. The kernel inside that fruit is very delicious. When the fruit gets matured, the stalk becomes rotten and the light hollow thalamus floats on water. Later, the flower itself becomes rotten and the fruits are discharged which gradually sink down to the bottom of the pond. New seedlings of lotus grow from these fruits.

In ancient days the root, stem, leaf, stalk and seed (in other words, the whole plant) were used as food. Measles, Pox, etc. are treated with the extract of lotus plant. Lotus-honey is very good to eyes.

(Two) Mango

Indeed there are a number of unlucky persons in our country but perhaps no such one as never tasted or heard the name of mango. Mango tree is found in abundance in our country—by the way, in the gardens and groves and even in the forests.

Even in the ancient days, Mango-tree played an important role in human society for this tree has been mentioned in the legends and literature, temples and mosques. Twig of mango is indispensable in religious festivals of Hindus.

Mango is the king of fruits. Several palatable dishes also are prepared from mango for it does not usually grow for more than two or three months in summer. But the foods prepared from mango as mango-cake, mango-jelly etc. can be preserved

and eaten throughout the year. Mango-lemonade is an excellent beverage for soothing the body in summer. Ripe mango is second to none in taste, colour and odour.

Different kinds of mangoes are available among which more than 500 types are found in our country. Himsagar, Langra, Beganfuli, Phajli, Golupkhus, Bombai etc. are a few common types of high-class mangoes. 'Benarasi langra' of Uttar Pradesh has

Mango with leaf

a very popular market. Phajli of Maldaha district and Timiru of Andhra Pradesh are the two biggest types, a single mango often being more than 1 Kg. and a half. But the 'king of the kings' is the 'Afuz' or Alfanso which is mainly grown near Bombay.

A mango-tree is two to fifteen metres in height. But in a few forests mango-trees, greater than thirty

feet in height, are found. Along the medial portion of a mango-leaf, there is a stout prominent rib, called the *mid-rib* Such leaves with only one main rib are called unicostate types. Veinlets are produced from the mid-rib and they are spread towards the periphery. There is a thick growth of leaves at the apex of the branches. Mango-leaf has a shinning appearance. The leaf, as a whole, has somewhat spear-like appearance.

The trunk of mango is quite stout and erect. The wood of mango-tree is quite durable and hard ; hence it is used for making furniture and also as a fuel.

Flowers are produced during January normally. At the apex of a branch there develop a few inflorescences which bear flowers. The buds of mango are yellow in colour and their odour is very sweet. The flowers are not so nice in odour but yellow in colour. Mango, i.e. the fruit, develops from the flower.

Mango inflorescence

A stony seed remains inside the kernel of the mango. Ordinary mango has a kernel full of fibres.

The mango, which grows directly from the seed, has much fibres but those produced by grafting have practically no such fibre. The later types are incomparable in smell, sweetness and taste.

(Three) Peacock

Peacock is not seen in the houses except those of extreme luxurious and rich persons. Peacock is quite large in size and very expensive. Men try to tame peacocks and take them in all places of the world. But India and Sreelanka (Ceylon) is their original abode. So, originally peacock is the animal of our country.

'Why it is the National bird ?'

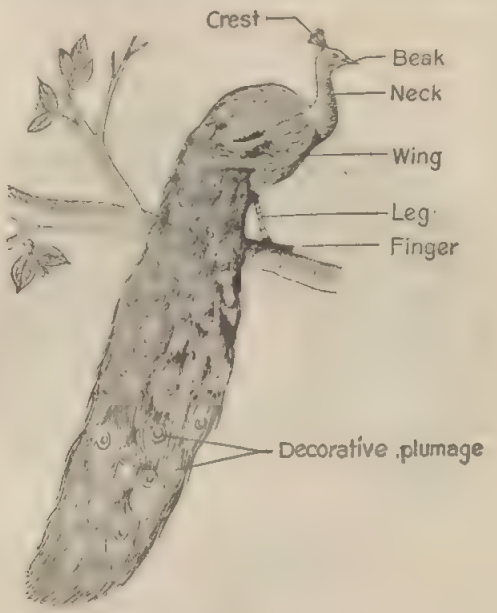
Peacock is found throughout the length and breadth of India. It has also an incomparable beauty due to its plumes. So, the government of India has made it the 'National bird' on and from 31st January of 1963.

In ancient days, the plumes of peacock were the articles of decorations in sacred and other jubilating ceremonies.

Its head is small and the beak is strong and stout. There is a small crest on the head of both the male and the female. The head and the trunk (i.e. the main body) is connected with a long slender neck which enables the bird to move its head at will in all directions.

Peacock has, like other fowls, two legs. Its wings (obviously two in number) are very stout. They can fly through a quite good distance. A little above the digits of its slender legs, there is a short

bone covered with a fold of rough skin. If the tail and two plumes are not taken in the account, a peacock is almost as large as a matured vulture.



Peacock

Peacock is two metres in length in which one metre is covered by its plumes only.

The colour of peacock is so beautiful! The colours of the neck and the plumes speak eloquently of the excellence of the "Artist of Nature". White peacocks are also found. The plume of peacock is one of the wonders in the world. It looks so charming when a peacock distends the feathers in the rainy season. But the pea-hens cannot do so for they have no such plumes. These plumes are present towards the tail of the peacock but they are not really tail-feathers. The tail feathers are simple and

devoid of any special colouration. The plumes grow over the tail-feathers and cover them completely. These plumes have a colour which is somewhat a unique combination of red, green and blue, with a wonderful 'eye' near the end.

Peacock with decorative plumes extended

Peacocks do not live separately but form groups. They love to live neither in bare meadows nor in dense forests. Bowers beside the fountains, not-so-thick forests, etc. are their favourite places where they can move freely. In such places, their enemies are also fewer in number. Peacocks are found in all places extending from the costal region to the hilly places, four to five thousand feet high. Hilly moppice is their favourite abode. A peacock generally forms a group with four or five pea-hens, though they are sometimes found to live without forming such groups. They move hither and thither

during the day and pick their food, mostly from the ground, and sleep on the branches of the trees at night.

Peacock is very shy by nature. It is extremely mild-tempered and becomes tame easily. But it is also very alert and quick in action. This is why it is really difficult to catch a peacock. But peacocks often move normally in the farmyards and meadows near their dwelling places. They seem to be "half-tame" animals of the whole hamlet. It is really a pride of India that such a paragon of beauty originally belongs to this country.

(Four) Tiger

Its Fame : Whenever we speak of mighty and ferocious animals, we refer to lion and tiger. There are a few lions in India but not in West Bengal. But the tiger of Sundarban area of West Bengal has a world-wide fame as 'Royal Bengal Tiger.' Besides them, tigers are also found in North Bengal, Terai region and in ferests towards the base of the Himalayas. The tiger found in Siberia is largest in size in the world.

Why National animal ?

Among the two gracious animals, lion and tiger, tiger is more abundantly found in India and unlike lion, certain species of tigers originally belong to this country. For these reasons, it has been given the appellation, "*National animal.*"

Appearance :

In structure and behaviour, tiger is much similar to our household cat. A special type of large and

extremely stout teeth are the main weapon of a tiger with which it bites and tears the flesh. The paw of tiger is very strong and it has the capacity of hiding its sharp stout nails inside the paw at will. The eyes of a cat glitters at night. The eyes of tiger look just like fire-balls in dark for they are larger in size and glitter all the more. The body of tiger is covered with thick hairs. There are black stripes on yellow ground in its body. The ear is also black with a white spot on it. The contrast of colour is not so prominent in the old tigers as it is in younger ones. White tigers are occasionally found. In old tigers, long hairs are present on the neck, the tail is quite long and tapering at the end. The length of the tail is half of the length of its head and trunk. The male tiger has a height of three feet generally ; the female ones has a bit less. A tiger is longer than a lion in size. It may be as long as 2·8 metresand 200 to 457 kg. in weight.

Abode :

It is not always true that a tiger will always be found in a dense forest. There must be a few bare places, rivulets and ponds nearby. This is why Sundarban is their favourite place.

Food and nature :

Tigers live on nothing but flesh only. So they are called carnivorous animals. A tiger takes rest in the forest during the day and goes in search of food at night. So it is called a 'nocturnal animal'. The tiger lies in bush near the ponds or rivulets or inside the jungle. When it gets a prey in its range

it jumps on the prey and snaps its shoulder. If it gets no food on land, it tries to collect food from the rivers. It undulates its paw under water and eat whatever it gets—a fish, a tortoise or even a crocodile. Tiger is a very good swimmer. There often takes place a serious battle between a crocodile and a tiger (see diagram in previous page). Tiger in necessary conditions, climbs on a tree. A tiger seldom gets tame even if it is kept from the cub-state.

A tiger never feels it difficult to catch a prey. If they once begin to prey cattles from the nearby hamlets, they feel it difficult to give up this habit and do not care men. You must know that tiger fears man very much until it becomes a man-eater. Tiger usually becomes man-eater if it somehow becomes too weak to catch other preys or if one of its natural weapons (claws, paw, teeth etc.) become invalid somehow by some accident or if it once tastes human flesh. Mostly, the old tigresses turn 'man-eaters.'

Birth : Cubs :

A tigress gives birth to two to three cubs usually. At the time of birth the eyes of the cubs do not open. The mother looks after her kiddies and feed them. But, sometimes the parents feed on their cubs. After about six months, the cubs become matured enough to move freely.

Tigon :

Tigon is a peculiar animal whose mother is a tigress and father is a lion (tiger + lion = tigon). Tigon has structural similarity with both tiger and lion.

We often mistake Leopard, Wolf etc. as tigers, but leopard is not, in the truest sense of the term, a tiger. Tiger and leopard simply belong to the same family. But the wolf is entirely different from tigers. They are carnivorous and extemely sly in nature and belong to the same family as that of dogs or jackels.

EXERCISE

1. Describe a beneficial and a harmful bird, known to us.
2. Which are cryptogams ? What do you know about them ?
3. Why Lotus flower is famous ? Describe a Lotus.
4. Describe the leaf and inflorescence of mango tree, what are the different uses of the plant ?
5. Which one is our 'National bird' ? Why and when did it get this fame ? Write what you know about its external structure, with special reference to its decorative plumage.
6. Why Peacock is known as the 'half tame' animal of the village ? Discuss about its nature and habitat.
7. Why Tiger is our 'National animal' ?

Write what you know about its nature and its method of catching the prey.

8 **Objective Questions :** Put a √mark beside the correct answer :

(a) Our beneficial bird is — Bulbul/Sparrow/Vulture/Roller (Nilkantha)

(b) Forms hives in large trees — Wasp/Bee/Green beetle (Kanch-poka).

(c) Emits light in darkness of the night — Moth/Glowworm/ Bee.

(d) Stings when attacked — Mosquito/Wasp Termite.

(e) The petals of Lotus are connected with each other/ separated from each other.

(f) Pollen grains are found in — Androecium/Gynaecium.

(g) "Man-eater" tiger is the — old tiger/middle aged tigress/ old tigress.

9. **Fill in the blanks :**

(a) None tames crow for their — is —

(b) The notorious thief among birds is —

(c) The nest of — bird is temporary, only for laying eggs

(d) — looks like butterfly.

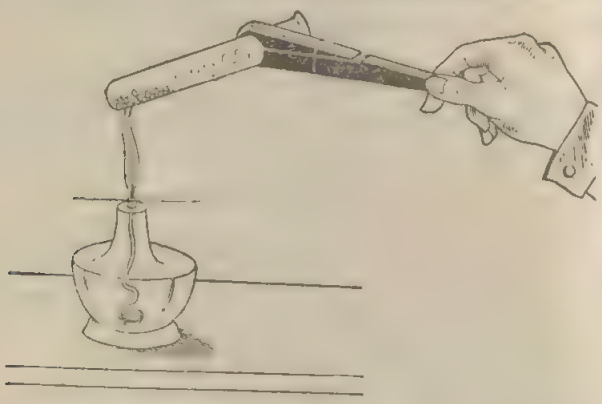
THIRD CHAPTER

OBSERVATION OF LIVING OBJECTS AND GENERAL INFERENCE

We gain our knowledge about the environment by our five sense-organs, viz., eye, ear, tongue, nose and skin. We come to know a lot of things about this world of life by seeing with eyes, hearing with ears, tasting with tongue, smelling with nose and feeling with the skin. Say for instance, if a block of brick be kept on a grassy lawn, the part of the lawn under the brick will be found to have turned yellow. If the grass be kept in such a condition for a few more days, it will die. What do we understand from this? Though grass draws raw materials with its roots from the soil, it cannot survive without getting light or air. So, it can be inferred that green plants do not survive in absence of light or air.

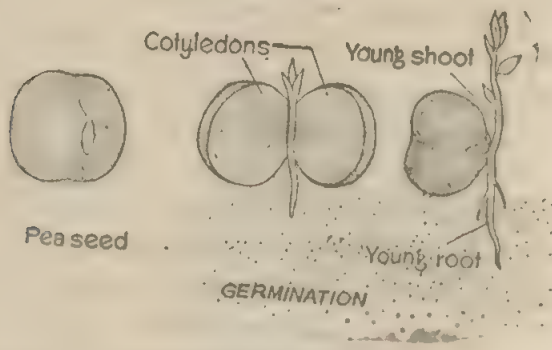
The fields dry up with the scorching sun of the summer. Again, that field becomes full of green grass after receiving water during the rainy season. But no one spreads the seed of grass in the field. Where from those seeds come? They must have been remained buried in dried state under the soil. Dry grams and peas are sold in the market. The gram when kept in water, swells up and softens by imbibing water. Now, life remains dormant inside the pea or gram seeds. When gram, soaked with water, is buried in the soil, radicle (preliminary root) comes out and soon a plant grows. But life cannot be retained without water. So, that apparently dry seed must have contained some water in it. A simple experiment

will make the truth obvious. Take a few dry pea-seeds in a test tube and heat them over a flame (spirit lamp or Bunsen burner). Now, drops of water will be



Dried pea-seed also contains water

found to condense on the upper part of the test-tube. The water present, in pea-seeds came out as vapour on heating and condensed on the cooler part of the test-tube.



Germination of pea-seed

So, it is obvious that all the features and characteristics of life remain dormant inside the seed, however hard it may be and the water necessary for retaining life remains inside that apparently dry mass.

When a pea is buried under the soil, a small slender body comes out ; a part of it is observed to move downward to form root and the other goes upward to give rise to shoot. So, it becomes evident that root has the tendency to move towards darkness while that of shoot (the part of the plant other than root) is to move towards light and air.

A Climber

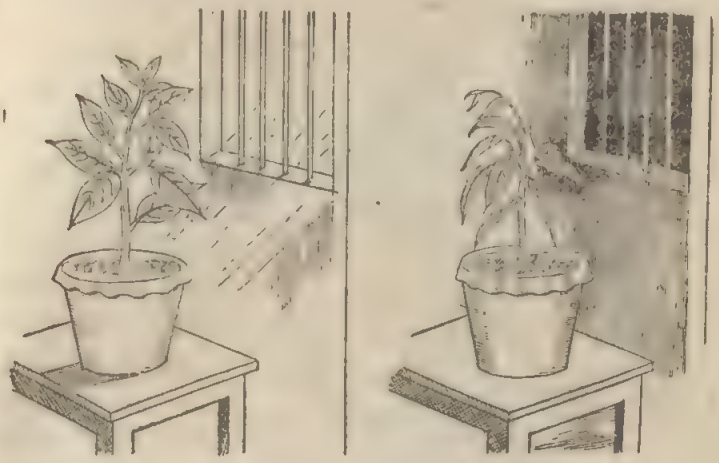
We often implant flowering plants in the pots. A few of these plants like Gourd, Passion-flowers, (Jhumkalata) etc. need a high platform for growing upwards properly. They usually have tendrils with which they hold the platform and move upwards so that they may properly spread their leaves against sufficient light. The above observation leads us to the inference that light is essential for the leaves of the plant for its activity. Actually, farther investigation shows that the leaves cannot prepare food without the help of sunlight.

Besides this, plant responds to light stimulus quite quickly. If you place a potted plant near an open window of a room which has no other source of light (all other windows and doors being kept closed), the plant will soon bend and grow towards that open window. Thus the plant will show clear response to light-stimulus. The response to light stimulus is also conspicuous in man. Do you not instanteneously shut your eyes when an intense beam of light falls on you from the head-light of a truck or a vehicle ?

Tendril of a creeper

There are a few cases where flowers blossom owing to the variation of light intensity and temperature. Water-lily and Krishnakali (B.) blossom in faint light, while 'Dupure' (B.) flower opens at noon (under intense light). Arabian jasmine, Sandhyamani (B.) etc. open in the afternoon. Sunflower always directs its face towards the sun and rotates throughout the day following the sun. (A devoted disciple indeed !). Another interesting case is that of the plant 'Kapati' (B.). Its leaves open during the day and collapse at night. The leaves of the *Mimosa* plant, Lajjabati (B.) close up as soon as they are touched, i.e., they respond to the stimulus of touch. So, our observations make it evident that plants, just like animals, respond to

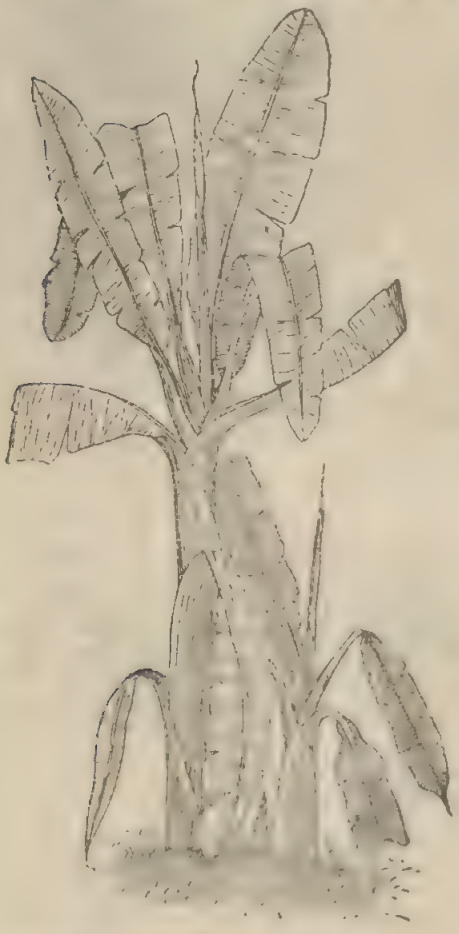
different kinds of stimulus as light, temperature and touch or contact.



Response to light-stimulus

Mimosa—Before and after touch : Response to touch stimulus

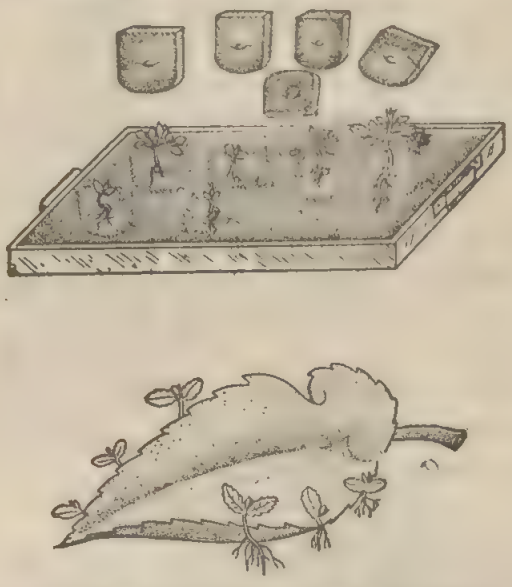
Along the bank of a pond, often a number of saplings are found to grow around a banana tree. If you pick carefully any one of them and implant at a distant place, it will grow up to give a mature plant.



Banana —grown-up and young plants

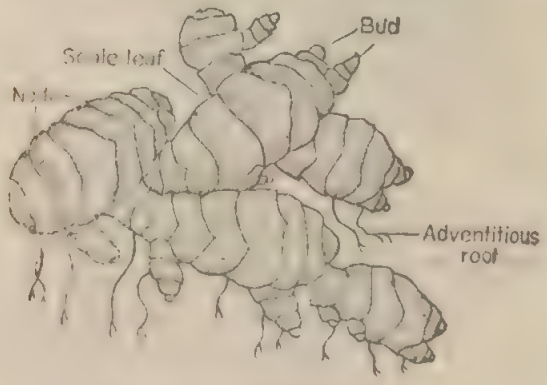
A banana tree may be grown without burying its seed. So, it is obvious that a tree may grow without a seed. Small yellowish-green outgrowths are often seen on the surface of potato (a common item of your daily dish) and the place from which such an outgrowth grows is called the 'eye' of potato. Now, a potato is cut into pieces so as to contain at least one 'eye' in each part. Now keeping the 'eye' upwards, the pieces are buried in a pot where some sand and sawdust (soaked with water) were kept previously. For a few days, the pot is drenched with water occasionally. It will

be observed after about ten days that young potato plants have grown from those 'eyes'.



Upper—young plants from 'eyes' of potato
Lower—young plants from Bryophyllum-leaf

A similar experiment may be carried out with

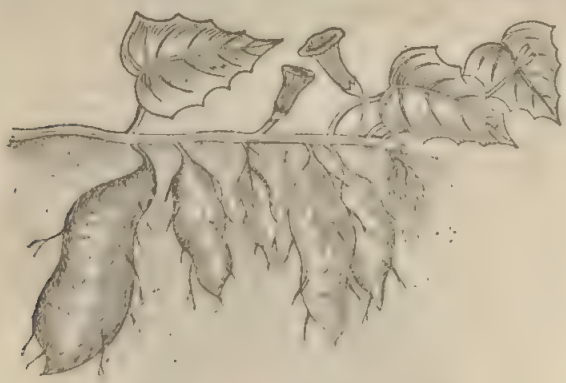


Ginger—not a fruit but a stem

ginger also. Actually, potato, ginger, etc. are not

the fruits of the respective plants ; they are stems (strange indeed !). As they reside under the soil, adventitious roots are found in their body. (A root, which is found in any part of the plant body except the normal position of the root, is generally called an adventitious root). Potato, ginger, etc. store up food materials for the plant and we eat them. Similarly, the roots of a few kinds of plants become swelled up owing to storage of food ; the most common examples are carrot, radish, sweet potato, etc. They are also capable of producing new plants.

Not only from roots and stems, a plant may grow from a leaf also. If you treat a leaf of **Bryophyllum**, Patharkuchi (B.), in the same way as you treated the



Sweet potato—not a fruit but a root

potato-pieces, small plants with roots will be seen to grow from the ridge on the two sides of the lamina. If the branch of some plants as Rose be implanted, it gives rise to new plant.

So, it is evident from here that new plant may grow not only from the seed but from the other parts

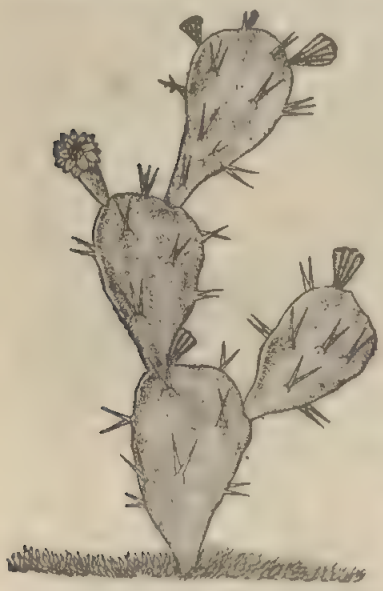
of the plant body also. But such process of generation is completely absent in animals (except in the cases of a few lower animals). If you cut one of your fingers and cherish it with all the cares possible, you will never get a friend who may be your cricket-partner ! There is another characteristic feature of plants. If one of the branches be excised, new branch often grows there. But, prompted by this instance, if you console a one-legged man that his lost part will grow soon, he will surely consider you mad.

Now let us have a walk in the field and gardens. Do you mark a banyan tree among a number of mango, jackfruit, pea-nut etc. ? A mango or a jackfruit may ripe, fall down and trees may grow from the seeds inside those fruits. But there is no other banyan tree nearby. So, how that tree managed to grow here ? The answer is simple. Say, a bird ate a fruit of banyan and could not digest its seeds. Now, it flew to this place and with its excreta, those seeds were egested, which, in future, brought forth such a massive plant. So, dispersal of these plants take place from one place to the other. This is the process by which the Indian fig-tree—Ashwatha, Banyan, etc. grow on roofs and carnice. The seeds of cotton

Banyan tree

are carried to distant places by the wind. There are several seeds which are dispersed in the same way by the help of wind.

Look at the date-plant. How sharp are the spines at the apex of its leaves! There are also spines and thorns in the plants like wood-apple, Prickly pear—Phanimanasa (B.), etc. Now, in the 'world of life', there are few things which have no function. Here, what is the function of those sharp bodies as thorns or spines? They protect the plant from the attack of different enemies as herbivorous animals, etc. So, those needly structures are the only weapon of the plants which are unable to move from one place to the other.



Pricklypear leaves form thorns

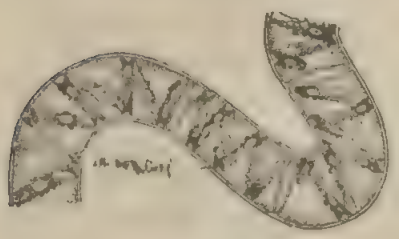
Do you observe the big red ants around that mango tree? Why the ants are here? Those ants build their nests by sewing a few leaves and reside inside those leafy 'mansions'. When some animal intends to harm the plant, they attack that poor creature (which at once leaves the place with several inflamations on its body). Thus, the plant protects itself by sheltering those ants. So, the ants and the tree prove beneficial to each other.

We know when a seed falls on the ground and

subsequently get proper light, air, water etc., a plant grows. Crops are yielded by careful cultivation. But who is that kind gardener who implanted these umbrella-shaped Fungi in cowdung ? No, there is no such person in this world. They are plants, but without the conventional structural characteristics. They are like umbrellas with long stalks. They have neither flower, nor fruit, nor even leaves. And as they are devoid of fruit, they have no seed also. Now, how can they grow without seeds ? Cut off the upper umbrella-like portion with a sharp instrument. From the centre of that rounded structure, several spoke-like bodies have run towards the circumference. Spores remain encased in those spokes. If you keep this umbrella inverted on a paper with a glass-bowl covering it, on the next day you will find several spores scattered on that piece of paper. New Fungus grows from such spores. The Fungus, (of some other type), which grows on leaves, wet shoes etc., also propagate themselves by means of such spores. Now, observe the colour of the Fungi. They are white or brownish, but not green. They cannot prepare their own food, then how do they survive ? Actually, they send several thread-like structures (not roots) from the basal part of their stalk into the body on

Mushroom

which they grow, and absorb food matters thereby. They cannot survive except in wet shady places and hence they mostly grow in the rainy season. A few types of Fungi are eaten by men (as a nice change in the dish !) but not all of them. But the algae (Sing-Alga) can prepare their own food for they contain green pigments (chlorophylls). So, we may infer from the above observations that the lower plants can continue their life-process in some way or other, though they are often devoid of conspicuous leaves, stems or roots. We also come to know from that, the lower plants propagate themselves by spores and those plants, which do not contain green pigments, collect prepared food somehow, for they cannot prepare their own food.



Algae

When the vegetables are cut into pieces, worms are often found inside them. Say for instance, many brinjals have no spots on their outer surface but they are ultimately found worm-eaten. Actually these worms are larvae. When a worm lays eggs on the flower and the flower develops to a fruit, the egg resides inside the fruit. Ultimately, larva hatches out of the egg and takes the fruit as its only food. So, though there remains no external markings, the fruit turns worm-eaten.

Besides plants, there are many animals around us. Do you not become exasperated with cockroaches,

flies, mosquitoes, house-flies etc. all the time? Mosquitoes, house-flies etc. spread infectious diseases. A keen observation may make you aware of the fact that they often sit on our foods just after

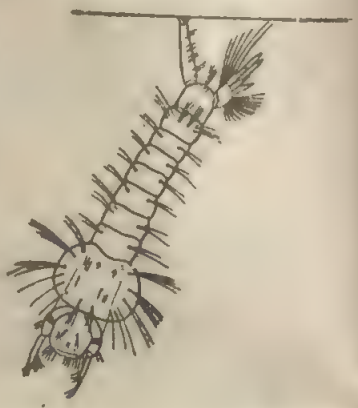
Insect larva inside brinjal

having some rest on excreta, spittle, rubbish etc. If you observe a house-fly with a lens after killing it by immersion in water, you will find numerous hair-like structures in its legs. Dirts and germs often stick to these hairs (Sometimes also in the wings). As it sits subsequently on a dish of food, these germs and dirt adhere to the food. Now, you must have become aware of your tiny but too dangerous enemies.

The disturbance of mosquitoes intensifies mostly at the middle of the rainy season. You have observed the fact for several times but have you tried to find out the exact reason behind it? The simplest answer would be that the mosquitoes are born in large numbers at that time. Because the mosquito lays eggs

in the water of earthen pots, containers, drains, ponds etc. If you collect some water containing eggs of mosquito, you will find after a few days that small worm-like animals are wriggling inside the water. They are the larvae which have hatched out of the eggs.

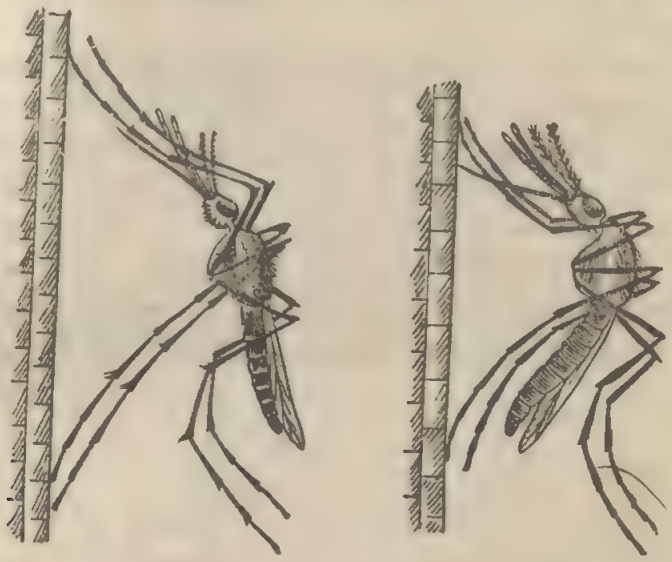
Culex pupa



Culex larva

After a few days, the larva transforms to pupa which has a , -like shape. This pupa, through a few changes, turns to a mosquito which flies away. Now, as mosquito lays eggs in water, if you keep your home clear and do not allow water to remain stagnant anywhere, the laying of eggs may be controlled (and the disturbance in your study-hours simultaneously !). Mosquitoes are generally of three types, among which the *Anopheles* and *Culex* are common in our country. When Anopheles bites some one, the germ of Malarial fever, carried by it enters one's body and infects. Similarly culex is responsible for the spreading of Filaria. Here, it is to be noted that, only female mosquitoes can bite and they do not always carry germs with them (otherwise it would be troublesome for druggists to manufacture

so large a quantity of quinine regularly!) It is easy to distinguish Anopheles from culex by



Anopheles ← Mosquito → Culex

observing some characteristic features of these two mosquitoes;

Distinguish Anopheles from Culex :

(1) When Anopheles sits, the hind part of its abdomen remains lifted (see figure) so as to make an acute angle with the substratum. But culex sits in a somewhat bent position with its abdomen nearly parallel to the substratum.

(2) Culex has its activity for 24 hours while that of Anopheles is generally at night.

(3) Unlike Anopheles, culex produces a humming sound with their wings during flight.

(4) Unlike Anopheles, Culex has white and black striations on its wings.

(5) Culex is generally larger than Anopheles in size.

Now collect a cockroach and kill it by immersing in water (you will get plenty of them in your kitchen or store-room). The body of a cockroach is divided into three parts—head, thorax and abdomen. Careful observation will discern two bean-shaped eyes on the two sides of the head. You will also mark two conspicuous antenna in its head which it frequently moved during its movement (to find

Cockroach—(wings cut off) seen from side

the position of an object nearby). Behind the head there is a thorax on which you will find a peculiar triangular structure. There are three pairs of legs attached with the thorax. Those legs seem to be formed by joining small rod-like structures and hence they are known as *joint-limbs*. All types of insects like mosquito, house-fly, locust, cricket butterfly etc. and several other animals as prawn, crab etc. have such joint-legs. The abdomen which lies next to the thorax is divided into a few nearly identical parts.

Now, if you go to some lonely place like the roof, garden etc. where there are a few flowering plants,

you will find colourful butterflies flying here and there from one flower to the other. Spot a butterfly sitting on a flower and try to observe it (with extreme silence) when you will find it to bend its mouth on the pollen of the flower. This is their food. Not only the butterflies, but bees, hornets, wasps, grasshoppers also search for nectars from one flower to the other. When fruit grows, the flower withers away and the fruit continues to grow. When an insect moves from one flower to the other the pollen of the former flower comes in contact with the other, and by this process, a fruit comes to grow.

During flight, the sounds produced by the wings of bee, hornet and wasp differ from each other. They have sting, and piercing the sting they protect themselves from their enemies. Bees construct hives in woods and jungles—on the branches of tall trees. A hive contains thousands of small chambers in which Queen-bee lays eggs, which ultimately develop to thousands of bees. Worker-bee accumulates honey inside the hive which man collects by suitable manoeuvring. The hive itself gives wax.

The insects, which we see mostly in daylight, takes rest at night. You have surely seen spiders which are present in most of the houses. They weave peculiar nets with a fine fibre-like substance. Actually a liquid secreted by their body dries up in air to give these fibres. The net is a sure death-trap for a small insect. The spider lies in ambush and devours the insect as soon as it becomes snared. The spiders are also joint-footed animals. A spider

has a pair of short and bent appendage which pours poison through the pointed end on the captured insect to weaken it. A female spider is larger in size than a male one.

Spider-webs

At night, you will find a number of small insects around a source of light. An insect, similar to butterfly, though not so colourful, is often seen. It's name is **Moth**. A moth spreads its wings when it sits, while that of a butterfly remains folded in a similar condition. There are a large number of insects which rush towards light while a few animals like owl, bat etc. shrink from light. So, it is evident from this that animals, just like plants, respond to light. It is very interesting to observe how a house-lizard catches insects. It comes near the insect (walking along the steep wall) and devours it with an excellent skill. But have you ever thought why they do not slip from the steep wall? The answer is—they contain soft fleshy pad in the

digits of their legs with which they stick to the wall.

Finger-pads of house-lizard

Now let us have a walk around the ponds and fields. Look, just beside the bank, are swimming shoal of small fishes. It is the pond where tadpoles are born from eggs. Tadpoles look like small fishes but they are not so. See, how difficult it is to distinguish between the colour of water (as seen from above) and the colour of the dorsal surface of fishes! But the colour of their ventral part is much light, nearly yellowish-white. The colour helps the fish to hide itself from enemies. There are also some long-legged insects swimming near one side of the bank. Why are the legs so long or why their body is flattened in such a way?—To facilitate swimming, is the answer. Look at those small heaps of soil on the bank. They are the excreta of earthworm. Earthworm devours rotten organic substances like leaves and other small animals mixed with soil. So, it eats soil and enter more and more inside the earth. On coming out, they egest the soil out and thus the soil of lower level comes up as well as the soil becomes more porous and penetrable for light, air, water etc. So, earthworm, as if, acts to 'plough' the field and hence it is called the "friend of the farmer." Look at the parrot whose green colour has almost become uniform with colour of the leaves. There are a number of

Tadpole

such animals as show a striking similarity of their body colour to that of their environment. There are also a few animals which look or *mimic* like other animals (or plants). The body of a dragonfly, with its slender green stalk-like appearance, is hard to distinguish from the surrounding grass or foliage (not only it is hard for us, but for the enemies also). The phenomenon is known as *mimicry*. Look at there ! A cow is chewing something during its rest in the comfortable shade of a tree. Such chewing is called "chewing the cud." There is no food ; and then what it chews ? These animals, during their grazing, swallow hurriedly all the foods they get. Now, in their leisure hours, they bring somehow the swallowed food out from the stomach again to their mouth and chew properly. Then they swallow it for a second time which leads to a proper convenient digestion.

Earthworm

You may observe a caged pigeon and a similar guinea-pig in your class. Touch with your hand and feel that the body of pigeon and a similar guinea-pig are quite warm ones, just like that of you. But touch a toad and feel how cold and moist is its body. The body of fish also is cold and slippery. Its body is covered with scales and devoid of any hand or leg. There are only a few paired and unpaired fins. So, the body of guinea-pig, bird, man etc. remain warm, i.e. the blood inside

their bodies remain warm. So, they are called *warm-blooded* animals. The blood of all other animals (which have blood at all) is cold and hence they are called *cold-blooded* animals. Again, there are hairs on the skin of guinea-pig, man, dog, cow, goat etc.. They do not lay eggs and are born alike directly from their mothers. The baby grows up by suckling it's mother's breast. So such animals are called *mammals.* But, the birds, reptiles (like snakes and lizards), fish, frog etc. lay eggs and are hatched out of the egg. Hold the pegion by your hand and feel how light it is ! A few insects, as cockroach, also fly, but their wings are made of skin. There is feather in the wings and body of no other animals except of the birds. Ostrich cannot fly considerably but can run very swiftly ; hence it

From above—Pigeon, Toad
Guineaipig, Fish

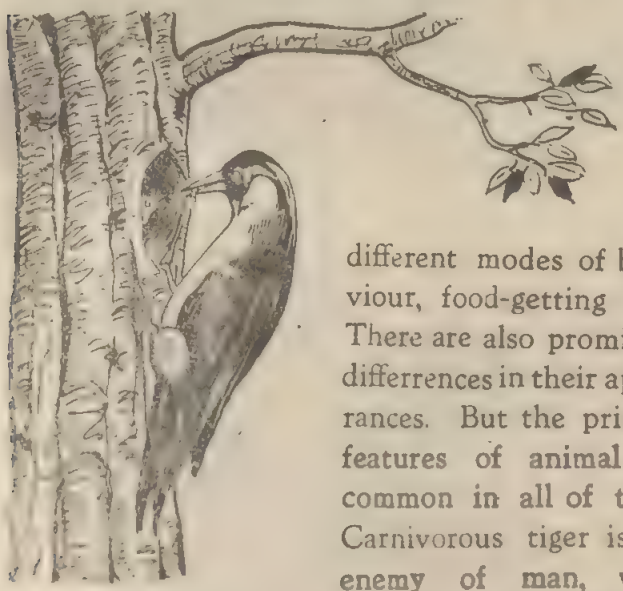
is called a "running bird." Observe the pegion keenly. It will seem as if the hands have been transformed to the wings. This is true for all the birds. The digits of all the birds are suitable for walking or sitting on the branch of a tree for they are sharp and curved. The beak is projected, hard, but without teeth. So, the birds do not chew but swallow food. Their eyes are quite large to provide them with a clear vision while flying.

Duck

Not only by the help of vision, but hearing their notes also, we can become aware of different animals as cats, dogs, cows, mice etc. Ducks collect their food by searching in water. The toes of their feet are connected by a thin fold of skin. Such a foot is called 'webbed foot' which facilitates swimming. Frog moves on the ground by hopping and swims in water. Its paired hind-feet are longer than the fore-feet. The digits of the hind-feet are webbed like those of duck.

Webbed feet—Above—Duck. below—Frog

Now, let us draw a more generalised conclusion from the above observations. In all the animates we have found a few common characteristics for maintaining their life-process. Different kinds of plants grow in different places and environments ; so a difference in their mode of food-taking, nutrition, reproduction etc. becomes consequent. But the primary characteristic features of plants are discerned in all of them. Similarly, different animals, during the course of their life process, have been scattered in different environments and adopted



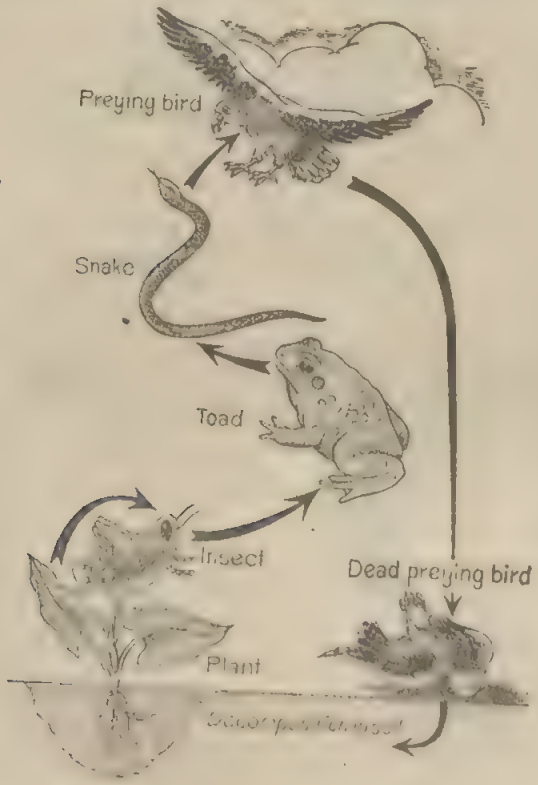
Wood-pecker in nest

different modes of behaviour, food-getting etc.. There are also prominent differrences in their appearances. But the primary features of animal are common in all of them. Carnivorous tiger is the enemy of man, while herbivorous cow is beneficial to them. Mosquitoes, houseflies etc. spread infectious diseases and harm us while honey and wax of honey-bee or silk of silk-moth is of great use.

The diversities among the animals and plants of different environments are clear. Say for instance,

the nest of wood-pecker looks nice in its environment and suits its nature completely. Similarly, the burrow of earthworm is the exact place where it may feel greatest comfort.

However, we have formerly discussed (in the first chapter) how plants and animals depend on each



Interdependence of plants and animals

other in their life-process in spite of maintaining their individual characteristics. Actually, all the animals have to depend in some way or other on the plants for they and only they can prepare food from carbon-dioxide and water where, except

sunlight, presence of green pigment in plant leaf is the essential condition. The carnivorous animals are also dependent on plants in some indirect way. Deer draws nourishment from herbs and this nourishment is stored up in the form of flesh in the deer's body, which is ultimately eaten by tiger. The annexed figure will show that, there is a conpsicuous relation between the 'eater and the eaten.' A number of animals live by eating only other animals. But the body of all the animals, after death, become decomposed by bacteria and get mixed up with soil and the fertility of the soil increases thereby. Plant draws nourishment from that soil and grows up.

Maintainence of observation-diary for Plants and Animals :

The different specimens of plants and animals, which you can collect easily, should be studied carefully and your observations in particular should be noted in an "observation-diary." Besides this, you may-develop in you the practice of studying different plants after growing them from respective seeds. Observe whether the seed is monocotyledonous, or dicotyledonous. the young plant is creeping in nature or erect, and what are the natures of its leaf, flower and fruit. Now tabulate those characteristics according to the table given below.

You may perform similar experiments and observations with animals also. You may collect some water with the eggs of mosquitoes and gradually note the structures of larva and pupa developing from the egg. You may use a glass-jar and a

magnifying glass for this purpose. Similarly you may observe a caterpillar by keeping it in a pot. The pot should be covered with a perforated lid and a few young leaves it eats should be kept in it to provide food to the creature. Now note how the caterpillar gradually transforms to pupa and ultimately to a colourful butterfly. The observations should be tabulated as directed below.

Plant :

Note in the diary according to the following process :

(1) Name of the plant... ... ...
(2) Place of collection... ... ...
(3) Date ... ...

Seed and sapling observation Diary :

Sow the seed and observe							
Number and name	stem	leaf	flower	fruit	structure of the seed	when, which change occurs	sketch

Plant observation Diary :

Name of the plant	The month in which flower grows	The month in which fruit grows	The month in which fruit ripens	seed	remarks
Mango					
Jack-fruit					
Guava					
Date/ palm					
Wood apple					
Tama-rind					

Animal observation :

Date	Name the speci-men	Food	Of what kind	Struc-ture	Struc-tural charac-teristics	Place of nota-tion	Remarks

Observation of different stages of insects :

Name of the stage	Date of collection	Name of the season in which collected	No. of days after which change of stage occurs	food	peculiarities	Structure	Name of the tree from which collected	Colour	Remarks/name of the insect
Larva									
Pupa									

EXERCISE

1. Describe what you know about Algae & Mushroom. How do they derive nourishment ?

2. How does fixed plant defends itself ? Narrate the process citing a few examples.

3. How can we save ourselves from the mosoquitoes ? Discussing the life-history of mosoquito, describe how they are harmful to us.

4. How will you recognize chordates ? Mention their characteristic features. To which group of animal, does man belong ?

5. Explain with examples, the inter-dependence of plant and animal.

6. Write with examples, how do seedless plants reproduce ?

7. (A) **Write short notes on :**

(a) Bee-hive, (b) spider-web. (c) Nest of wood-pecker, (d) The brinjal-worm.

(B) **Write the differences between :**

(a) Anopheles and Culex mosquito.

(b) Butterfly and moth.

(c) The tadpole and the fish.

8. **Fill in the blanks :**

(i) The green plants prepare their own food with —, —, — in presence of —.

(ii) Mushroom prepare food—

(iii) — flower changes in direction with the change of position of the sun.

(iv) The stem of plant goes — and the root goes — earth.

(v) Animal body gets mixed up with — after death and increases — fertility.

(vi) The animals, whose legs are jointed, are known as —

(vii) The wing of a bird has —.

(viii) Toad and duck swim, for they have—

(ix) Plant spreads out its leaves, for getting—

(x) — has no teeth, so it swallows its food.

(xi) — catches insects with its tongue.

7. **Objective-type Questions : Put a √ mark to the correct answer :**

(a) Lives in water — Moss/Fern/Bladder-wort.

(b) The flower blossoms at night—sunflower/rose/jesmine.

(c) Shark is a — Reptile/mammal/Fish.

(d) Bat is a — Mammal/Bird.

(e) The sensitive plant Mimosa, when touched closes leaves because of — shyness thrust touch stimulus.

— — —

FOURTH CHAPTER

REQUIREMENTS OF LIVING OBJECTS :

Find Through Experiments :

It has been discussed formerly that living objects have Several characteristics of their own which are absent in non-living ones. But living objects are dependent on the inanimate environment around them ; say for example—light, air, water etc. If these things are not supplied upto the required extent, it becomes difficult to carry life-activities. Both the plants and animals are meeting basic necessities for continuing life-processes from the inanimate environment. The simple experiments described below will show that living object depend on light, air (oxygen). water and food for maintaining life.

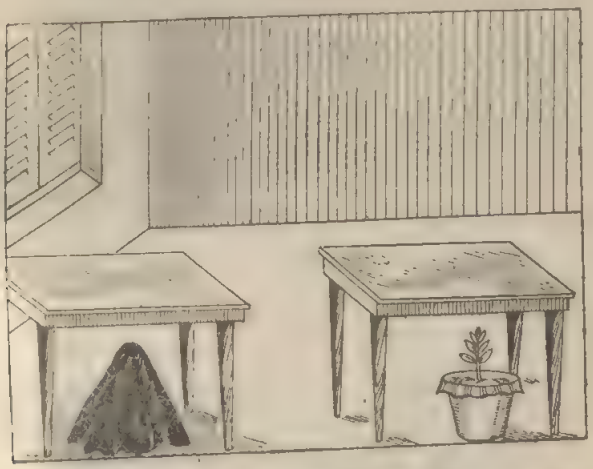
(a) **Living objects need light :**

'Light is life'—goes the proverb. Just shut your eyes and you will feel how necessary light is in our life. We fear darkness for we cannot see without light and hence we want to move from darkness towards light. For, if we are unable to see, it will be impossible to do many important works, including the collection of food, to maintain life. It is light which has made life vigorous.

Green plants prepare their food in their leaves. Light is an essential factor in doing so, for, if there is no light, the green colour of plant will vanish gradually. Thus the plant will die.

Experiment :

Keep two potted green saplings under a table at the corner of a room. Now fix three sticks (almost equal in size) around one pot and place a black thick piece of cloth over the sticks so that the plant in that pot becomes completely covered. The cloth



Covered ← Potted plant → Uncovered

should reach the ground to prevent the entrance of any light. But keep the other pot in normal condition. Water those plants properly in the dark of night.

Observation :

After a few days, you will observe the covered plant has become very weak and somewhat withered. Its leaves will turn yellow. On the other hand, the plant in the other pot will be found to have become larger and stronger.

Inference ;

The plant which was covered to provide no light, got necessary air and water. But owing to want of light, it failed to prepare its food and could not continue its life-process normally. If the plant were kept in a similar condition for a few more days, it would die. So, light is essential for plants to live.

(b) Living Objects Need Air (Oxygen) To Live :

Energy is necessary for maintaining life. Any type of movement or activity needs energy. Coal burns in air to give light and heat which are different forms of energy. We get such energy from food. To release energy which remains stored inside food, oxygen is required which a plant or an animal takes from air (or from water in dissolved state) during the course of respiration. In this process, carbon dioxide (a gas which is injurious to animal-body) is produced and exhaled. The oxygenated air, which is taken in, is known 'as inhaled air' while the air rich in carbon-dioxide, which is given out, is known as 'exhaled air'.

Plants also perform respiration just like animals. Air comes in and goes out through minute openings on the leaf. There are also some plants which respire through their body. Now, it is evident that both the animals and the plants are respiring. (ie. taking in oxygen and giving out carbondioxide) throughout twenty four hours. Then why all the oxygen in this world do not get exhausted ? We never have such a deficit for the fact that, during the preparation of their food, plants

produce oxygen at a high rate and release this excess of oxygen in air. Thus the balance is maintained.

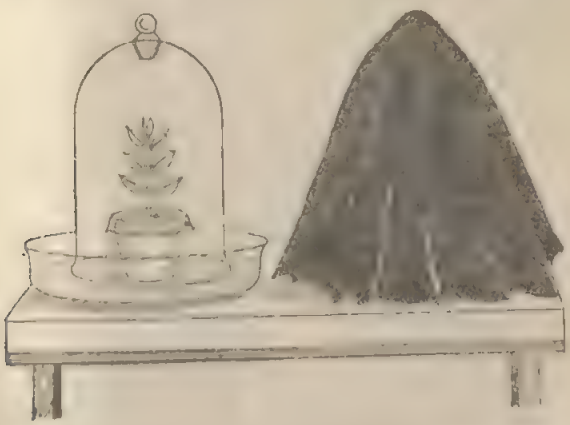
The simple experiments described below will show the necessity of oxygen to the plants, animals of land and those of water.

First Experiment :

Two big dishes, whose edges are lifted, are taken and some water is poured in each of them. Now, two saplings (planted in tubs) are placed one in each dish and covered with a bell-jar. You may carry the experiment with the help of any bell-jar-shaped glass vessel, if a bell-jar is not available. Now, one of the tubs is completely covered with a thick piece of cloth and kept at a dark corner of the room.

Observation :

After a few days, the plant covered with black piece of cloth is found to wither and become



Plant require air (oxygen)

weakened while its leaves have turned yellow. But the other plant remains nearly normal.

Cause :

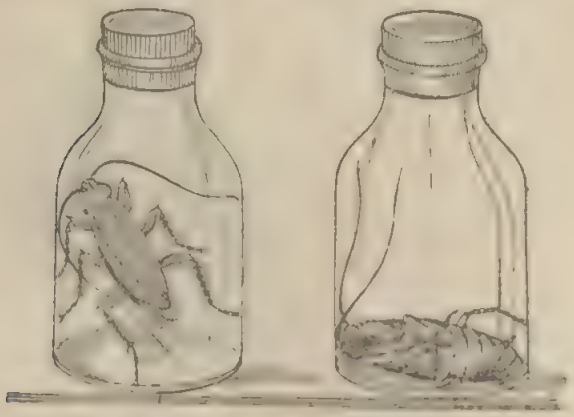
Both the plants under experiment got raw food-materials from the soil of the tub. But the covered plant could not prepare its own food owing to the absence of light and it soon used up all the oxygen inside the bell-jar by respiration. It did not get any further supply of oxygen for it could not prepare food. This is why, it became weak. On the other hand, the other plant (not covered with black cloth) could prepare its own food for it received light. During the process of food-preparing, it released oxygen and used this for respiration. So it did not become weak. If the first plant be now kept in normal condition, it will regain its former strength, other-wise it will die surely.

Inference :

It is evident from the above experiment that oxygen is necessary for plant ; in absence of oxygen it grows weak more and more and dies ultimately.

Second Experiment :

In a wide-mouthed glass-bottle a little sugar is



First stage Second stage

kept and a cockroach is put inside. Now the mouth of the bottle is tightly corked so as to prevent the

entrance of air. After a few minutes the cockroach will be found in somewhat struggling condition and then it will become languished.

Cause :

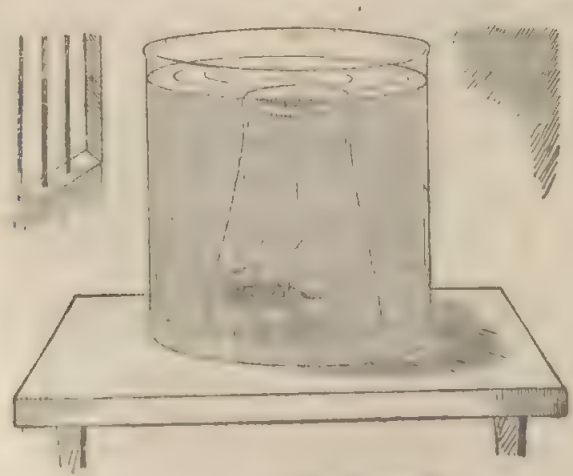
Cockroach uses atmospheric oxygen for respiration. The little oxygen, which was inside the bottle, was soon exhausted by cockroach and hence it become restive owing to the want of oxygen. If the cockroach be kept in such a condition for a few minutes more, it will die.

Inference :

Terrestrial animals (i.e., which live on land) take up oxygen from atmospheric air for respiration.

Third Experiment :

2/3rd. of a large glass-beaker is filled up with water and a cockroach is put inside it. The cockroach



Cockroach in water (covered)

will surely try to escape from the beaker (showing little eagerness to die in the hands of a novish

biologist !). So, a glass is inverted over it so that the upper surface of the glass remains under the level of water. Thus the cockroach will remain confined inside water.

Observation :

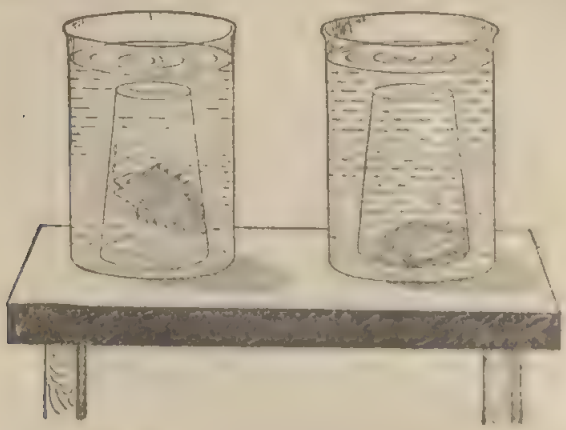
The cockroach is found to strike the surface of the glass continuously. After a few minutes it will drop and die.

Inference :

Cockroach is a terrestrial animal. So it cannot utilise oxygen dissolved in water as the aquatic animals (like fishes) can do.

Fourth Experiment :

Two koi fishes are taken (the size should be as small as possible) and each of them is kept in a beaker



First stage Second stage

full of water. Now, a glass is inverted over the first beaker so that the upper closed surface of the glass remains under the level of water.

Observation :

In the first beaker koi moves freely sometime and then strikes the upper surface of the glass (1st. stage). After a few minutes it becomes languished. On the next day, the fish is found dead (2nd. stage). In the second beaker (not shown) koi swims inside water freely and occasionally rises upto the free surface of water releasing a few bubbles.

Cause :

Fish is an aquatic animal (i.e. lives in water). It performs respiration with the oxygen dissolved in water. But a few particular kinds of fishes like koi cannot complete their respiration without utilising atmospheric air, even when they get plenty of dissolved oxygen. For this purpose they have accessory respiratory organs.

Inference :

Fish usually dies in a few minutes after lifting it on the land. But koi (also Shingi and Magur) cannot complete respiration with the oxygen dissolved in water. They need atmospheric oxygen equally. Thus koi, a common habital of water can be killed by immersing in water (a severe irony of fate indeed !).

(C) **Living Objects Need Water :**

It goes beyond saying how great is the need of water in the life of a living-object. Starting from the water used for washing hands and face in the morning to the glass of water taken before going to bed—several gallons of water are used by a man in each day. Water is all the more important for

plants, for they draw raw food materials from soil in dissolved state.

The following experiments will prove the necessity of water in the life of living objects :

A plant cannot take hard substances. They absorb mineral salts in a state of dissolution in water.

First Experiment And Observation :

A small potted plant, if kept in the sun for a few days without watering the tub, it will droop

In watered condition

not watered

and ultimately die. Before death, if it is properly drenched with water, it will regain its former vitality.

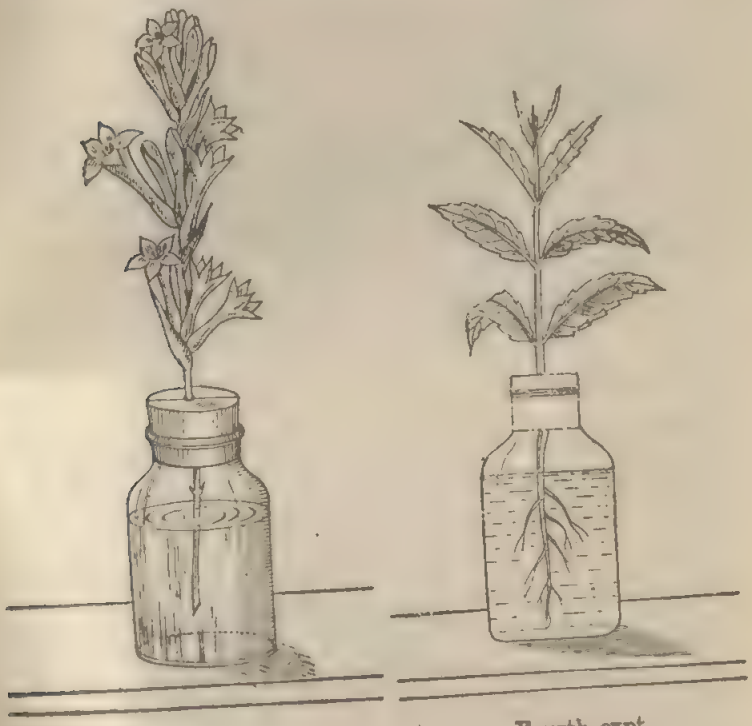
Inference :

Even in presence of light and air, a plant dies if there be any want of water.

Plant absorbs water by its roots. The second experiment will show where water goes inside the plant.

Second Experiment :

Three-fourth of the volume of a narrow-mouthed bottle is filled up with water. A balsam plant (small in size) is taken out from the soil with its shoot undamaged and the roots are washed. Now



Third expt. Fourth expt.

a little cosin (or any red soluble pigment) is mixed with the water of the bottle and the lower part of the plant is introduced into the bottle through a split-cork. In this condition, the root of the plant remains under red water while its shoot (stem and leaves) projects outside.

Observation :

If the sapling be taken out on the next day and a thin slice (cross-section) of its stem be examined with a magnifying glass, red spots will be found in that white cross-section.

Inference :

Plant absorbs water with roots and transfers it to different branches through the stem.

Third Experiment :

A stick of tube-rose is taken and the base of the stick is removed smoothly. Now it is placed in a bottle of water similar to that in the above experiment.

Observation :

The white petals of tube-rose will be found to turn reddish on the next day.

Inference :

Water moves even upto the flower through the stem and the branches.

Need of water is equally obvious in the life of animals. After a walk in the summer-sun, you will surely need badly a glass of water. There are numerous persons who belong to the list of the fellows who died of thirst in deserts. You may perform simple experiments with little animals.

Fourth Experiment :

A bird (or, a small animal like a mouse) is kept in a cage and adequate food is supplied. But no water is given to it (what a cruelty !). In another cage a similar animal, with food and water, is kept.

Observation :

After merely one day, the bird in the first cage is found to struggle seriously. It takes no food also

Second cage First cage

in such a condition. On the other hand, the bird of the second cage is found normal. The bird in the first cage dies in one or two days.

Inference :

The bird in the first cage died for the want of water though it got air, light and food in adequate quantity.

(d) Living Objects Need Nutrition :

A living object cannot continue its life activity without proper nutrition. In the above experiment, if the bird be supplied with water but no food, it will die in this case also. So, a living object needs water as well as nutrition equally.

we know, a plant absorbs mineral salts diluted in water with its roots from the soil.

First Experiment And Observation :
" Plants do not survive with water only"

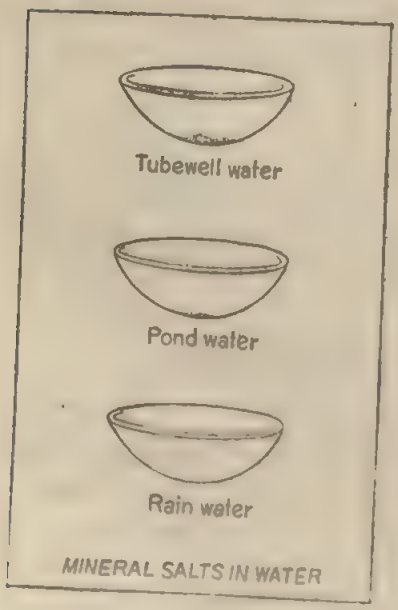
It you collect a balsam seedling with its organs (like roots, stem etc.) undamaged, and now place it in pure water, it will remain normal for two to three days after which it will droop and die.

Inference :

A plant cannot live normally if it gets light, air and water only. It also needs mineral salts dissolved in water.

Second Experiment : "Mineral salts remain dissolved in water."

Three small watch-glasses are taken and they are filled with clear pond water, tube-well water and rain water respectively. Now the three watch-glasses are kept in sun until water in each dries up. After the drying up of water, the first two watch-glasses are found to contain a whitish solid substance in minute quantity (adhering to the wall of the watch- glass.) But the third watch-glass is found to contain no such substance. Again, the



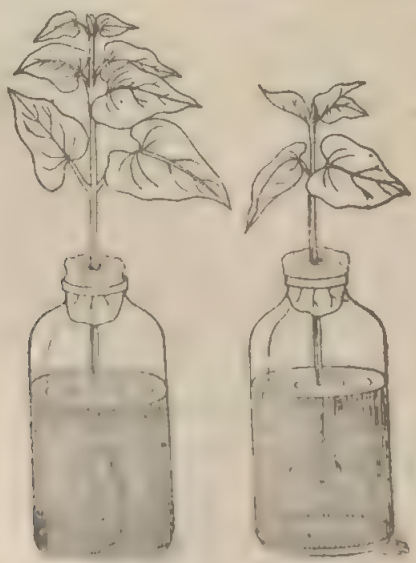
watch-glass containing tube well water shows greater quantity of such substance in comparison to that containing pond water.

Inference :

Solid substances which remain dissolved in pond-water and well-water, are salts available in the soil. Rain water contain no such salt. Again as the well-water comes from a deeper source, it dissolves more of such salts and hence the quantity of salt in the second watch-glass is greater.

Third Experiment : "plants need mineral salts dissoloved in water."

The experiment will show how necessary are the mineral salts in the life of plants.



First bottle Second bottle

$\frac{1}{3}$rd. of a beaker is filled with the soil from a garden and rain-water (formerly collected) is

poured into it. Now the soil is vigorously stirred with a glass-rod and is then allowed to settle down. The turbid water above the sedimented soil is now collected in another beaker. Now, two narrow-mouthed bottles are taken. $\frac{2}{3}$rd. of the first bottle is filled with this turbid water and $\frac{2}{3}$rd. of the other with rain water. Now, two similar seedlings are so placed, one in each bottle, that the roots remain under water and the shoot projects upward. The two seedlings are kept erect by plugging the mouth with cotton.

Observation :

The growth of the seedling in the second bottle (containing rain water) is found to be much slow in comparison to that of the seedling in the first bottle. After a few days, the seedling of the second bottle dies and that in the first bottle continues to grow healthily.

Inference :

Plant for its normal activity and growth, needs not the soil, but the mineral salts mixed with it. These salts are taken by the roots in a state of dissolution in water. Plants obtain nutrition from the food prepared from these salts.

The need of mineral salts is not only of the plants, but of the animals also. We also are in the necessity of a few salts as calcium, iron etc. We can get these salts from milk, meat, egg, vegetables and 'water from the soil' e.g., well-water, spring-water, pond-water etc.

EXERCISE

1. What is the necessity of water in the life of a living object ? Explain with experiments that no plant or animal can live without water.

2. What is respiration ? Why life can not continue in absence of air ? – Explain with experiments.

3. What is the requirement of light to a plant ? Why no green plant can live without light ?

4. Explain, demonstrating experiments that plant can not live only in rain water.

5. Demonstrate by an experiment that there are mineral salts in natural water.

6. **Objective Questions : Give a ✓mark to the right answer :**

(i) The food-mixed water is conducted through the body of a plant and spread out —sporadically/travell through definite channels.

(ii) The potted plant in the room grows towards the window for—light,/air,/heat.

(iii) A 'Jeol' fish (with accessory air-breathing organ) can be killed if kept drowned in water because — it cannot live in water/it can not get light/it can not get air.

(iv) A cockroach can be killed by immersing it into water, for — it can not live in water/does not get air/it does not get light.

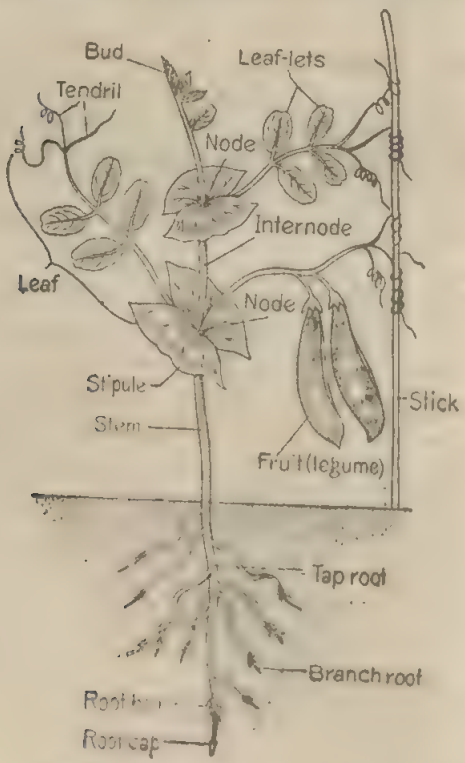
FIFTH CHAPTER

BASIC EXTERNAL STRUCTURES OF PLANTS AND ANIMALS

Plant :

(*a*) *Basic External structures of plants* : *Example—Pea.*

If you observe a pea-plant minutely, you may gain



Chief external features of a pea-plant

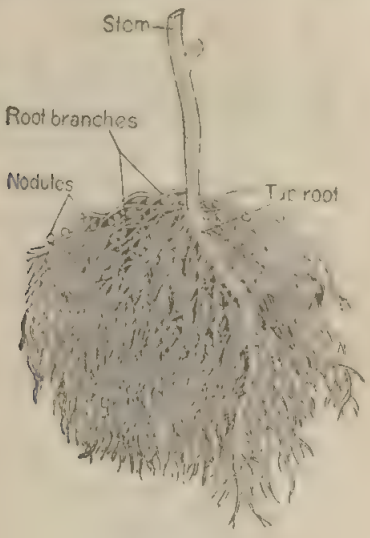
a first-hand knowledge about the basic external structures of common higher plants as a whole.

Collect a pea-plant in such a condition that all its parts may remain undamaged. Now let us start our discussions. The green part above the ground is known as shoot and the whitish part under the ground is known as root. The shoot may be divided into a few parts. The first or basal part of it is called stem. Branches are given off from the stem, and leaves, flowers and fruits remain connected with the stem or its branches. So, a pea plant is formed of root, stem, leaf, flower and fruit. Pea plants grow in winter season and on attaining maturity it produces flower. The flowers develop into fruits which enclose seeds. New pea-plants are grown from these seeds.

Root :

On observing the root carefully, it will be seen that the root has developed from the base of the shoot and gradually taperred towards the end. This long structure is known as the primary *root*. On examining with a magnifying glass, a small cap-like structure. known as root-cap, will be seen at the tip of the primary root. The cap protects the tender soft tip of the root from the frictional damage in soil. Just above the *root-cap*, numerous hair-like structures are found to project out from a certain region of the primary root. They are known as *root-hairs*. They fix the plant in the soil and absorb water (and dissolved mineral salts) from the soil. Above the root-cap, there are several secondary or tartiary roots given out from the primary root. The branches often become matted. Each of these branches also has root-cap and root-hairs. In

pea-seedling the pea-seed remains in a position under the ground but just above these matted tertiary roots. In the roots of pea-plants, there are several nodules present. The shoot system develops



Root-system

upwards and the root system downwards—both from the seed. The food for seedling remain stored inside the seed.

Stem :

The first part of the shoot is called *stem*. In pea-plants it is tubular and somewhat hollow (you may feel the hollow with your finger). This is why a pea-plant cannot stand erect on the ground ; hence it moves upwards by the help of some support. This type of stem is known as climber.

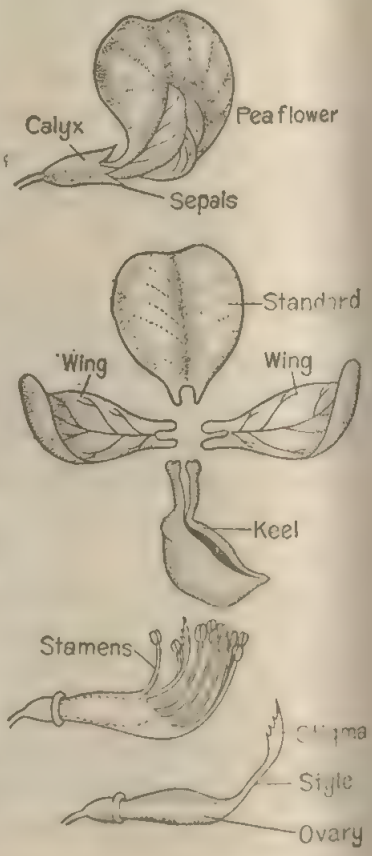
Leaf :

Leaves have been produced one at a time at certain intervals on the Stem. The spot of the stem, from which such a leaf grows, is known as *node.* The space between two nodes is known as *internode* which contains no leaf. Now observe the leaves. The leaves are green like the stem. At the tip of the leaf-base there are a few small leaf-like structures called *leaf-lets.* These leaflets are arranged on the two sides of a common stalk, like the feather of birds. Such a leaf as a whole, is called a *compound-leaf.* At the apex of the leaf, there are a few slender filament-like structures called *tendrils,* which are really modified terminal leaf-lets. These tendrils coil round any sort of support (like sticks, platforms, which is commonly called 'mancha' in Bengali, or a tree nearby) and with the help of these tendrils, the plant moves upward. There is another interesting feature in the structure of a pea-plant. Encircling the node, there are two large fan-like leafy structures known as *Stipules.* Stipule is also a part of the leaf. There are numerous fine lines on the surface of the leaf. They are the veins and veinlets of the leaf. Thus the pea-plant leaf is so much different from the mango tree leaf, which you have studied earlier.

Flower :

When the seedling grows up and attain maturity, flower blossoms. Flower develops from the axil of the leaf, i.e, in the angle between the stem and the leaf. At first a bud grows in the axil and the flower soon comes out of the bud. Each flower

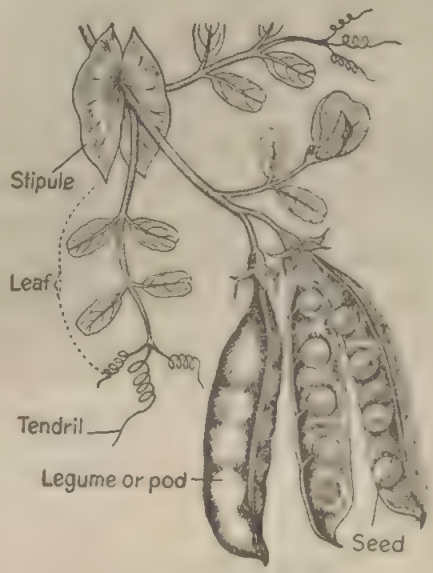
contains a small stalk. At the tip of the stalk there is a platform on which the different parts of a flower are arranged in *four whorls* in a circular fashion. The platform is known as *thalamus.* At the base of the flower, there is a green tube-like small covering known as the *Calyx.* This is the *first* whorl of the flower. The upper part of the calyx-tube is divided into five parts (like five teeth) each of which is known as *sepal.* Just above the calyx is the *Second* whorl on which the *petals* are arranged. A pea-flower has *five* separate petals. The five petals form the Second whorl which is known as *Corolla.* The petals are white in colour. The petals, as a whole, assume the appearance like a butterfly for, one of the petals is much big in size—like a *hood.* It is called *vexillum.* The vexillum guards the other four petals. On the two sides of the vexillum are the two petals which are similar to wings, hence they are known as *wings.* The other two petals, interior to the wings, have joined along one margin longitudinally to



Different parts of a pea-flower.

assume a boat-like appearance. They are known as *keel.*

In the colour and fragrance of these petals lies the beauty of the flower. The insects, being attracted by these, come and sit on the flower.



A branch with fruit

The third whorl of the flower is called *Androecium.* It consists of *ten stamens.* Each stamen has (a) one long *filament* (b) a flattened *anther* mounted on the filament. Among the ten stamens of the pea-plant, nine combine to form a tube and the tenth stamen remain separate. The anthers are swollen bodies containing *pollen grains* inside them. At the middle of the flower is the fourth whorl called *Gynaecium.* The Gynaecium consists of only *one Carpel.* The base of the carpel is swollen, flattened and hollow. It is known as *ovary.* The future *seed* resides

and develops in the ovary. The upper part of the ovary continues as a long hollow tube known as *style*. The tip of the style is flattened and round. It is called *stigma*. The pollen grains from the Androecium of one flower reaches the Gynaecium of that or other flower by the legs and wings of the insects as they move from flower to flower.

Fruit :

Ultimately, the flower withers away and the fruit comes out of the flower. The fruit of pea is called a pod or legume. The seed remain arranged inside the pod along a medial line. When the pod ripens it bursts and the seeds fall scattered on the ground.

Now, examine a pea-seed. It is nearly round in shape and covered by a light-yellow membrane. The young pod, which we eat, is green in colour.

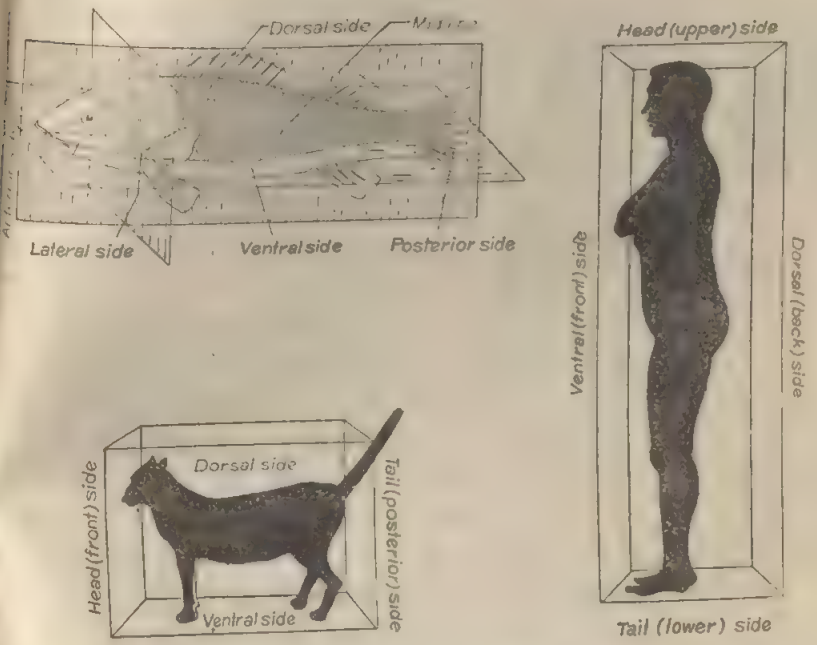
2. Animal :

Basic external structures of animal body :

Before discussing the structure, you should know a few terms concerned with a few planes or faces (or sides) of the animal body. Say for instance the hind plane, the front plane etc.

When we walk, we move along the direction of our sight. So, the plane in which our eyes are situated is our front (side). But fish moves in the direction of its head (and not the eye which is situated upwards). So, the part in which its head lies, is its front (side). The case is similar for a dog or a cat also. Again, the tail of a fish or a dog is

situated directly opposite in position to the head. So the part, in which the tail lies, is the hind side



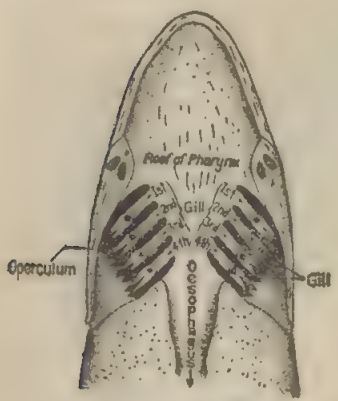
Different planes of animal body

of a fish or a dog. But as we walk in vertical position, the side of our back is our hind side. From the above diagrams it will be clear that how different is the mode of movement in different animals as man, dog, fish etc. All of the above-mentioned animals can be cut longitudinally into two exactly identical halves by starting from the anterior end and proceeding along the medial line of the body.

(b) Basic External Structures of Fish.

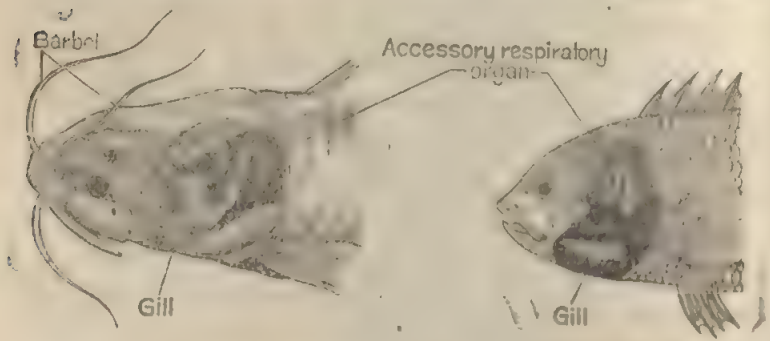
Amongst the animals in the world which have backbone, fish is largest in number.

Fish is an aquatic animal. Here you must be aware of one likely mistake that prawn is not a fish, it is a lower animal without a backbone. Again, shark is a fish. Fish are rich in proteins and certain species are selectively included in the dietary of man. A few yield commercial products.



Arrangement of gills

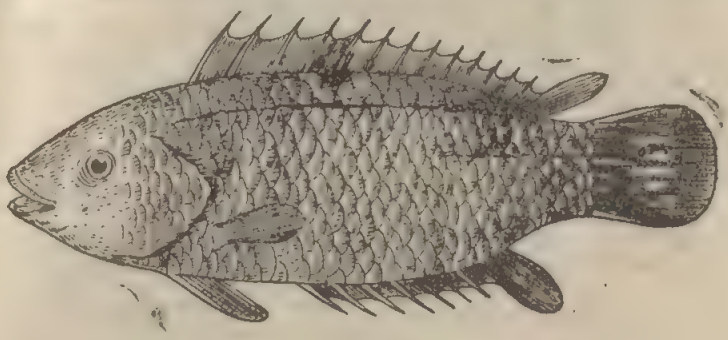
Water of rivers, canals, ponds etc. is sweet. Large carps like Rohu, Katla, Mrigel, and Shingi, Koi, Magur etc. live in this water. A few marine fishes are also edible and tasteful. A few tasty fishes are available at the mouth of the rivers also (i.e. where the river meets the sea). You know that a few 'Jeol'



Magur Koi

fishes like Shingi, Magur, Koi etc. can live comfortably in very little water and even in absence of water for some time. This is possible for they

have accessory respiratory organs. A slippery slime secretion is secreted from the body of fishes. Fishes



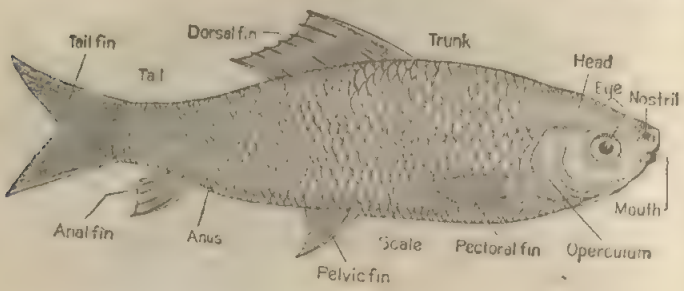
Koi fish

live on small organisms, like algae, protozoa, worms, small crustaceans etc.

Observe, the body of a fish is elongated as a whole and taperred at two ends, while the middle portion is much swelled. The body is flattened dorso-ventrally. This particular shape of the body is known as 'stream-lined' body. This helps the fishes for easier and faster movements in water. The anterior part is called head, the portion just behind the head, which is more swelled and well-built, is called the trunk and the hind-part of the body is called tail. There is a large fin in the tail. So, the body of a fish is made of three parts—head, trunk and tail. A fish has no neck.

The body of Rohu is covered with scales except a small region near the nostrils. Shingi, Magur, Tangra etc. have no scales, the body being naked. However, the scales of Rohu are arranged like tiles, each covering the anterior part of its hinder scale, i.e., overlapping one another partially. If one of the scales

be taken out by means of forceps, it will be found somewhat round in shape. The middle of the scale is thick and the marginal portions are thin. In each



Rohu fish

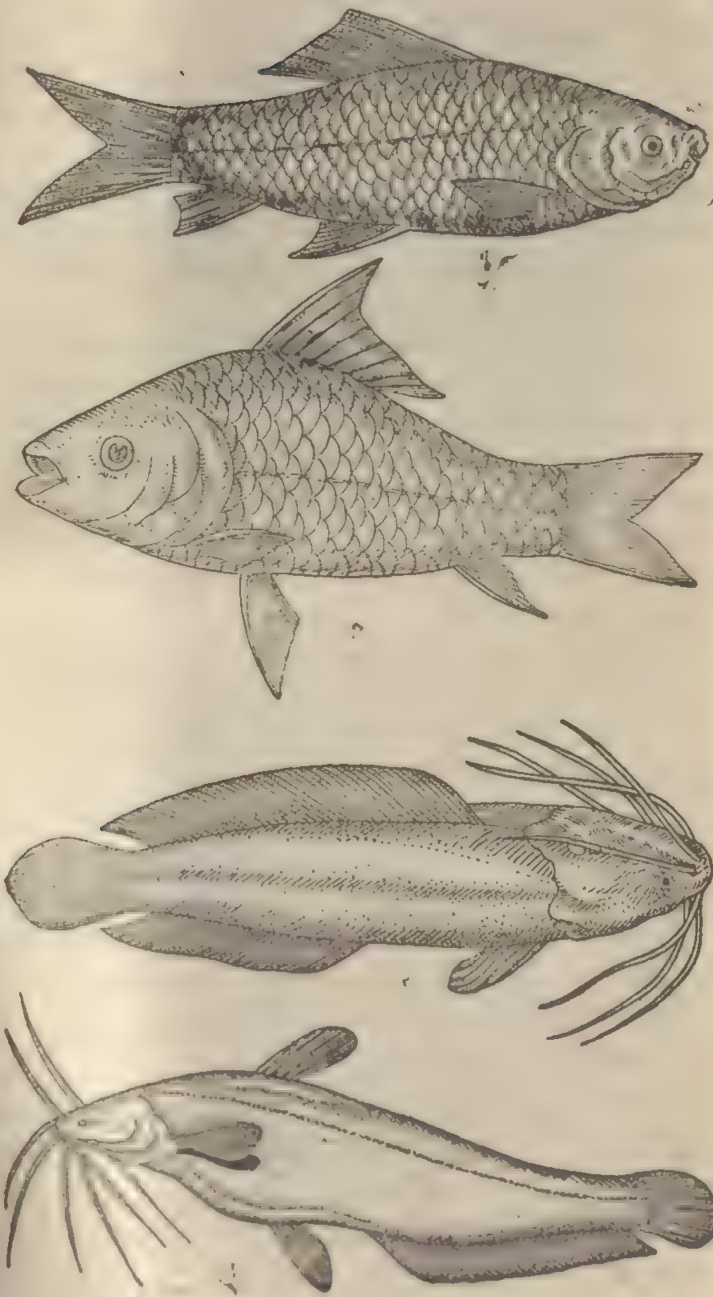
scale, there are a few circular marks, gradually increasing in size. The scale of koi is not like that of Rohu in structure.

There are *seven fins* in the body of Rohu. The fins seem to be formed by webbing a few minute bony rods, known as fin-rays, with a fine membranous skin. There are a few fins which occur in pairs while there are a few which occur singly. The former type is known as *paired fin*, while the later as *unpaired fin*.

(1) Paired fin :

(a) Just behind the operculum, there is one fin on each side of the body known as *pectoral* fin. In Shingi and Magur, there is a sharp *spine* in each of the pectoral fins.

(b) Just at the end of the trunk, there is another pair of fin near the pelvis. This pair is known as *pelvic fins*.



From above—Rohu, Katla, Magur, Shingi

(2) **Unpaired fin :**

(a) On the middle of the dorsal surface, along the mideal line, there is a large fin known as *dorsal fin* [dorsal means 'back'].

(b) Behind the trunk, where the tail is taperred, one *anal fin* is present on the side of the abdomen.

(c) At the end of the body, there is a large fin in the tail known as *caudal fin.*

By moving the different fins, a fish floats in water, swims up and down, moves here and there and springs up. The fins are comparable to hands and legs. They float in water in a balanced position and also moves up and down by the help of paired fins. They mainly keep balance with the pelvic fins. By moving the caudal fin, they can change the direction of their motion at will.

On the two sides of the body, nearly at the middle, two narrow but distinct lines extend from the hinder part of the head upto the tail. These are called lateral lines. Fish has no ears.

The lateral line serve as a sense organ ; direct and control their movements according to the sound-vibration received by the lateral lines. With the lateral lines, they can perceive sound waves in water.

Head :

The front portion of the head is taperred and the hinder portion is broad. At the tip of the head, there is the opening of *mouth*, bounded by two jaws. On the upper and lower part of the mouth-opening, there are two fleshy lips present in Rohu. Two

barbs are present, one in each of the spot, where the two lips meet laterally. A little behind the mouth, there are two pores on the dorsal-side, these are the two *nasal openings*. A fish does not respire with its nose but smells. On the two lateral sides of the head, there are two large round eyes. Fish has no upper and lower eye-lids like those of us. Their eyes are covered by a sort of fine transparent membrane. There are two large flaps made of bone on the two sides of the head ; these are gill-covers and are called *operculum*. A fish can open and close the lower part of the operculum at will. There are red comb-like structures present under each operculum. They are known as gills. Fish takes water by mouth and gives it out through the opercular opening by moving the operculum. In the mean time, gills absorb dissolved oxygen from water and thus respires.

The middle part of the body is trunk. This is the largest part in the body of a fish. All the fins except the caudal fin are connected to this part of the body. At the base of the tail region, there is a small depression in which there are three minute pores. This is known as *vent*. At the mouth of this depression, there is the anal fin. Faeces, urine and gametes come out through these pores separately. They are called anal pore, renal pore and gonopores respectively.

The portion behind the anal fin, as a whole, is known as tail. At the end of the tail, there is a caudal fin which is quite large in size. In most of the fishes like *Rohu*, *Katla*, etc. the hinder part of the tail fin is divided into two equal segments. But the tailfins of Bhekti, Koi, Lata etc. are small, undivided and round in shape.

Rohu generally attains quite large size on attaining maturity. Rohu weighing 20 kg. or more are often found,

Special Discussion On Fish :

The above discussions reveal that fish, in general, is aquatic in nature, though a few of them (e.g. Koi, Magur, Shingi etc.) can survive without water for considerable time. But it must be noted that even these fishes cannot live without water for ever. These "Jeol" fishes possess *accessory respiratory organs*. Another interesting fact is that, they (Koi etc.) cannot meet their respiratory requirement with oxygen dissolved in water only and peep their heads out of water to (inhale) take air through their mouths.

Yet, water is the permanent abode of the fishes. There are a few kinds of fishes which can fly for a few seconds in air. But they have to return to water ultimately. All the fishes die on lifting them up in the air, i.e., when out of water, they are out of breath.

All of you have seen (and tasted also !) the eggs of fish. The eggs are individually very minute in size. But innumerable number of eggs are developed in the paired ovaries. But fish spawn eggs singly.

However, after spawning, the eggs float away along the current. Eggs of fishes are the food of aquatic animals including fish itself. The animals

Shark

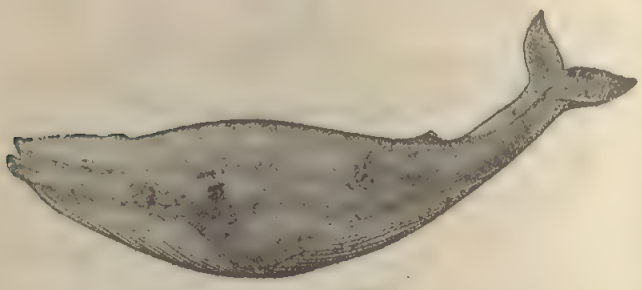
which devour their eggs or members of their kind are known as *cannibals*. But all the fishes are not so. There are a few kinds of fishes which show remarkable parental care and affection to their eggs and offsprings.

A few kinds of fishes give birth to their offsprings directly without laying eggs. *Labestes* fishes are of such nature. There are several faimiliar fishes, often kept in the aquarium, which lay no eggs (sword-tail, Guppy etc.) and give birth to young ones directly.

The size of fish may be small as well as much large. There are a few fishes which are herbivorous and a few, which are carnivorous. But most of the fishes eat plants as well as animals and they are known as omnivorous animals. Fishes usually move in shoals.

In the sea, numerous kinds of fishes are seen among which a few are very large in size. Shark is a cartilaginous type of marine fish. Though, commonly

the size of a shark is three feet nearly ; a certain kind of shark extends up to fifty feet in size. This type of shark is next to whale in size in this world.



Whale

Whale, though roughly similar to fish in appearance, is not a fish, it is a mammal.

In the annexed sketch, you will find that a whale has no "fish-like" paired or unpaired fins. It is a mammal. It does not lay egg, but give birth to its offsprings directly. The youngs grow up by suckling their mother's breast.

Sea-horse

In the sea, there also live a few fishes which are of very peculiar appearance. The fishermen often catch a fish named sea-horse, whose head looks almost like that of a horse.

(c) Basic External Structure of Man

Human Body :

Man is the most advanced kind of animal in both structures and functions. Man is much smaller than an elephant or much weaker than a tiger but what placed him above all the animals is his intelligence. Man is a mammal i.e., develops by suckling his mother's breast. The body of man is covered by small hairs and two prominent external ears are present on the two sides of the head. Man gives birth to the offspring directly which is similar to its parents in external features.

All the mammals, starting from guineapig, rat, cat, dog, cow, sheep etc. up to the rhino-tiger or elephant, bear a striking similarity in structures, both externally and internally.

Man is most widely scattered all over the world and two men from two different countries have almost entirely different etiquette, clothes, food, language etc. A German is white and tall, while a Pigmi is just opposite, black and short. Due to excess of sun, black pigments grow inside the skin which often turns a man black. Even in the same country, a Kashmiri has little similarity with a Madrasi in appearance. But will you ever face any difficulty to recognise a man as a man ? Never. For all of them bear some common characteristics as—

(1) Man is always with two legs with a perfectly erect position, which is impossible for any other animal.

(2) The nose is erect and straight.

(3) There is a small depression just above the upper lip.

(4) The lower lip is somewhat turned out.

(5) A prominent chin is present.

(6) The forehead is small.

(7) There are hairs on the body but rather less in comparison to other mammals. Unlike females, the male ones have beard.

(8) The head is placed on the neck in a balanced erect position.

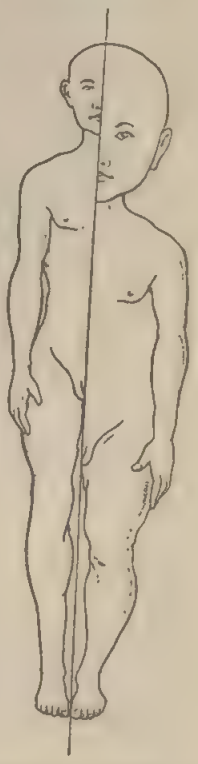
back-bone

Man and other vertebrates (i.e. which have a permanent backbone) have a frame made of bone, inside the body. This bone-made frame is known as endo-skeleton. Due to its presence, we can stand erect and move our limbs at will.

The portion of the endoskeleton extending from the neck up to the anus along the middle of the back is known as back-bone. It is not a straight structure but somewhat wavy and made up of a number of small vertebrae (singular-vertebra). What is the speciality in the structure of man ? Just like fish, a man has his body divided into three parts. But those three parts of both of them are not identical. The body of a man is divided into head, neck and trunk. On each side of the trunk there is one hand in the upper part and one leg in the lower part. The hands and legs of man

corresponds to the forelimbs and hindlimbs of a cat or the pectoral and pelvic fins of a fish respectively.

The appearance and the structure of a child changes continually as it grows up. The relation is roughly shown in the given figure.



Growth-proportion

Now, let us have an idea about the gross external features of a man.

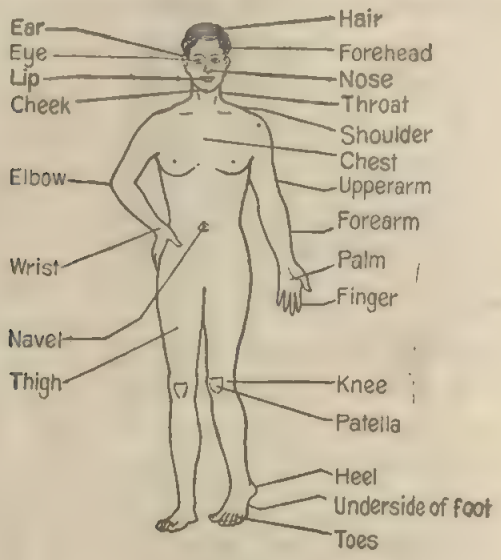
Head :

The endoskeleton of a man is covered by flesh and skin. Skin, which covers our body all through, is the outer covering. It partially protects the internal organs from external injury and environmental variances. Again, skin is one of our sense organs. We can perceive heat, irritation, shock etc. by touching something with our skin. Head consists of the skull and the face. Head is nearly round. The trunk and the head are joined by a neck. Hair is present in the upper region of the head. For easier discussion, head can be divided into three parts viz. forehead, mid-head and hind-head. There are two ears on each side of the head.

Nose :

The nose is situated beneath the forehead and in the middle of the face. It extends from the region where the two eyebrows join to a region little above the eyelid. The nose has two nostrils with which we inhale air from outside and exhale bad air from

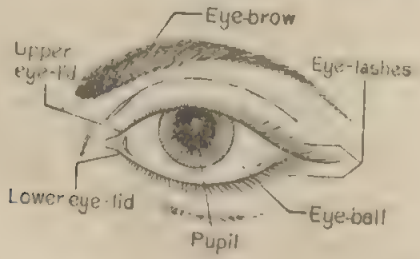
the body after respiration. Besides this, we can



Human body

smell with nose, i.e. perceive the sense of odour with it. So, nose is a sense organ.

Eye : The two eyes are placed one on each side of the region of the forehead from where the nose is raised. Just above the eye, there is one bow-



Human eye

like eye-brow on each side. Two fleshy eyelids protect eye from injury. Eyelashes are present on the margin of each eye-lid in a symmetrical way. The upper eyelid is greater than the lower

one. We can open and close our eyes by moving the upper eyelid at our will. But the lids blink periodically without our effort and this phenomenon is known as 'twinkling of an eye'. But the portion of the eye which we see from outside is not the whole. The white part of the eye seen normally is actually marbel-shaped. We can rotate our eyes to some extent in different directions. The white part constitutes two-third of the total surface of the eye. At the centre of this, there is a small round aperture called 'pupil'. We perceive the sense of light with the eye and hence it is known as a *sense organ.* An image of the object, which we are seeing, is formed in the brain with the help of the "natural camera," eye. But such formation of image being impossible without light, we cannot see anything in absence of light.

Mouth Cavity :

Just beneath the nose, there is a mouth-cavity guarded by two soft fleshy lips. When the lips are moved apart, the mouth opens. A thick, fleshy, light-pink tongue is present inside the mouth cavity. We perceive the taste of a food or drinks with numerous pappillae present on the tongue. The outer end of the tongue is taperred. There are two jaws which carries teeth. We have thirtytwo teeth in matured state. The teeth in young age (Milk-tooth) falls and permanent teeth grows out. When we speak or chew something vigorously (say, a Breast-cutlet), the lower jaw continuously moves up and down but the upper jaw remains fixed. The two jaws are hinged with each

other near the two ears. We eat and speak with our mouth and even respire by the help of it when the nostrils remain blocked due to cold or some other reasons. There is a chin beneath the lower lip. There is a small depression between the lower lip and the chin.

Neck :

A cylindrical body joins the trunk and head. The hind part of it is called *neck* and the front part *throat.*

Trunk :

Trunk is beneath the neck. It may be divided into three parts called *chest, abdomen* and *waist* (on the side of the belly). The two parts on the two sides of the neck is known as *shoulder.* A little below the shoulder, a bone remains projected which which is known as *clavicle.*

The first part of the trunk is the chest. Nearly in the middle portion of the chest, there are two mammary glands, one on each side. The next portion is abdomen or belly. Just in the middle region of it, the *navel* is present which is a small circular depression.

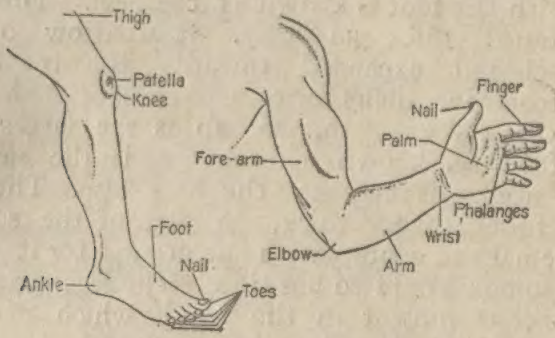
The hind part of the trunk is the back. Along the middle region of the back, the backbone extends and divides the back in two equal parts—right one and left one.

Due to the presence of a number of muscles, we can move and use the different limbs present in our body.

Forelimb or Hand :

The two hands are so joined with the shoulders that the hands can be moved round completely

without moving the body. Each hand has three distinct parts,—forearm, arm and palm. The forearm is joined to the shoulder. Arm is the next portion of the hand. The knot-like junction of the fore-arm and arm is known as the elbow. The wrist joins the arm with the palm. Palm is quite thick and fleshy with a few lines on it (ventrally). There are five fingers



Hind-limb Fore-limb

at the end of the palm. We can move our hand and fingers at will and can rotate a fist (made by the curving of the fingers). There are three markings in each finger at equal intervals. By counting those markings we often calculate numbers. Nails are present at the tip of the fingers. On allowing the nail to remain undisturbed, it grows and projects outside the finger. Nail, like hairs, is insenlient and we feel no pain if it is cut with a sharp instrument. Nail should be cut as soon as it grows, for otherwise it encloses much dirt (and injurious germs) inside. The skin of palm is very thick, that of the sole, i.e. lower surface of the foot, is all the more thick.

Hindlimb or leg :

Leg is also divided into three parts. Those three parts show such a unique co-ordination that they hardly seem to be different parts. The part of each leg connected to the waist is called the thigh. The fold of skin at the joining of the waist and the leg

is called the thigh. The fold of skin at the joining of the waist is called the groin. Thigh is the stoutest part of the leg. The thigh joins with the shanks forming a wedge at the knee. Stretching the leg if you press your knee, you will feel the existence of a small circular bone. This is known as patella or knee-cap. The region where the shank joins with the foot is known as the heel. The foot is flattened, thick and fleshy. It is narrow towards the heel and expanded towards the front side wherefrom five digits or toes have generated. The first toe, known as the thumb is the largest and the fifth toe, known as little toe, is the smallest. There are nails present in the toes also. The skin of the foot is very thick, A part of the sole do not remain in contact with the ground for it always keeps somewhat lifted position. The leg has several muscles, as present in the hand, which bear the weight of the body and do different work.

EXERCISE

1. Describe a pea-plant with a neat diagram.
2. Write short notes on :

(*a*) Pea-leaf, (b) Root, (c) Pea-seed.

3. **Fill in the blanks :—**

(a) A Pea plant grows up with the help of ——.
(*b*) A Pea-leaf is made of a few ——.
(*c*) The fruit of pea is known as ——.
(*d*) There is a —— at the tip of the leaf.
(*e*) In human body, the skin of —— is the thickest.
(*f*) There is a —— in the cheek of man.

4. Discuss the various sides or planes of an animal body.
5. Discuss the external structures of fish with a neat diagram.
6. Mention with examples, the differences between a common fish and a 'jeol' fish.
7. Describe the external features of a man.
8. Describe the sense organs of man and mention their functions with neat diagrams.
9. How will you distinguish yourself (as a man) from other animals ? Mention the characteristic features of man.